AMBULANT

Phase I: A Multi-Profile SMIL Player for Mobile and Desktop Systems

Project Final Report

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Version 1.0P
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Table of Contents

1 Report Abstract

The AMBULANT project has as its goal the study of the network and infrastructure aspects of multimedia delivery. The project is defined in three phases. Phase I will provide a stable, reliable and open multimedia player that can be used at CWI and elsewhere for research in networked multimedia; it will implement the main standards of the W3C without intellectual property restrictions and will be available under open source licensing to member of the research and development community. Phases II and III will consist of research into models and protocols for application-influenced network layer support of multiple end-to-end multimedia streams; this work will study issues in accessing, transforming and delivering presentations in a heterogeneous environment based on device, network infrastructure and end-to-end constraints.

Phase I of the AMBULANT project was executed during the period 1 April 2003 through 30 June 2004. It has resulted in the production of version 1.0 the AMBULANT SMIL 2.0 player, an open source implementation of the W3C SMIL language on Linux, Macintosh and Windows operating systems, for desktop, PDA and TabletPC platforms. The AMBULANT player is the only open source SMIL player that has been deployed for such a wide range of operating systems and platforms. It is also the fastest, most complete open SMIL implementation available anywhere.

The AMBULANT player was released in six incremental releases. According to statistics gathered by Source Forge, over 7,000 copies of the various distributions have been downloaded by a world-wide developer audience. The AMBULANT player is currently being used in three projects within CWI and in (at least) five projects outside CWI. Seven conference papers have resulted from the work on the AMBULANT player.

In total, approximately 2.5FTE manpower effort has gone into the development of the AMBULANT player. During the course of the project, approximately €5k was spent on equipment and €15k was spent on travel-related conference expenses. The cost of the project was covered by a grant from Stichting NLnet and from funding provided by CWI.

2 Original Project Goals

This section reviews the project scope of Phase I of AMBULANT. In particular, it summarizes the project's background, proposed workplan and deliverables. The actual results of the project, including dissemination, importance and partnership relationships, are discussed in Section 3.

2.1 Background

The AMBULANT player is part of a larger project that studies various network and systems aspects of supporting rich media in a heterogeneous, networked environment. The complete AMBULANT project is consists of the following phases:

- *Phase I*: development of a common playback environment based on current standards for multimedia presentation; this environment can be used as a basis for experimental research in later phases of AMBULANT and by other researchers who desire an open, tailorable player.
- *Phase II*: development of local models and languages to realize predictive support for multi-sourced media presentations though a dynamic network infrastructure for delivery to heterogeneous clients; and
- *Phase III*: development of end-to-end models to support predictive multi-sourced hypermedia, including the processing of links and alternative content based on network infrastructure and client dynamics

The AMBULANT player represents the first iteration of Phase I of the total AMBULANT project. Since systems such as the AMBULANT player are inherently dynamic — they must act both as a catalyst for and reflect the dynamics of new language versions — it can be expected that the development of the player will be an activity that will occur during the lifetime of the AMBULANT project.

2.2 Proposed Work

CWI proposed to coordinate the development of a multi-profile, multi-platform SMIL-2.0 player that provides full support for the main W3C standards used in multimedia applications. The player will provide a complete implementation of the various profiles defined or used with the W3C SMIL language (including the major mobile and desktop in use.) The player will be architected to run on the major platforms available to, and in use by, the research community. The software will be developed by a team of research institutes, each of whom has

experience in developing (partial) implementations of the SMIL language or associated W3C standards. All of the software and test suites provided by the project will be available under GNU open source licensing terms (or equivalent).

The purpose of this platform is to provide a common base for research into new network protocols and infrastructure support for multimedia. The project will be geared to providing a well-documented player implementation that can be extended or further instrumented by external parties.

2.3 Deliverables

We proposed to develop and distribute the following deliverables:

- *target platforms*[1]:
  — PDAs running WinCE
  — Tablet PCs running XP-Tablet
  — Desktop PCs running Linux
- *target standards*:
  — MMS (basic SMIL support for Mobile Multimedia Messaging),
  — 3GPP-PSS5 [19] (enhanced 3G mobile multimedia support), and
  — SMIL 2.0 Language profile (the full SMIL specification).
  Note that all three protocols were subsets of the W3C SMIL specification.
- *supported media types*:
  — streaming video (in the open, DIV-X implementation),
  — streaming audio and MP-3
  — streaming timed text, and
  — streaming images (PNG and JPEG).
  Only those codecs which were available under open source licensing terms would be integrated into the project.
- *supported transfer protocols*:
  — RTP/RTSP [14], [18]
- *implementation language*:
  — C / C++.
- *other deliverables*:
  The project would construct demonstrators and a test set to verify profile

1. These are the minimum set of platforms that the project intends to support. We expect to be able to offer support for other platforms (such as Linux on PDAs, optimized Win32 or MacOS support at no additional project cost, depending on the resources of the external development team.

and platform implementations. Conference articles discussing scheduling and control issues for heterogeneous platforms would also be produced.

The project would produce its deliverables in three releases:

- *Release A*: an implementation of the basic SMIL engine for each of the MMS, 3GPP and SMIL profiles. The initial implementation platforms would be: desktop (Linux) and TabletPC (XP/T).
- *Release B*: an implementation with extended support for a broad range of codec's for image, text, audio and video media. The target implementation platforms would be: desktop (Linux), TabletPC (XP/Tablet), PocketPC (WinCE).
- *Release C*: the final release of an optimized player, plus testbed and documentation. This release would be available twelve months after project start. All of the supported platforms will be included.

Each release would be seen as a go/no-go point for further releases. A licensing scheme would be developed to coincide with the provision of Release A.

3 Project Results

This section reviews the results of the AMBULANT player project. We discuss the scope of the completed work and the deliverables produced, as well as the importance and acceptance of our work.

3.1 Project Scope

The original scope of the AMBULANT player project was to define a SMIL 2.0 compliant player for WinCE/WinXP-Tablet/Linux. During the course of the project, the number of platforms was increased to include the Macintosh and the Zaurus Linux-based PDA. Support was also provided for various SMIL 2.0 dialects, including mobile SMIL. The media support included images (PNG and JPEG, plus GIF and other platform dependent support), audio (WAV, AIF, MP3 and other platform dependent support), and video (AVI and MPEG-2). Networking support included local, non-streamed HTTP and streamed RTP/RTSP support.

Detailed project scope information is summarized in the following sections and in Appendix A.

Platforms Supported

The AMBULANT player has implementations available for all major use platforms. The operating systems and platforms tested during the project are given in Table 1.

Operating System	Versions Tested	Hardware Tested	Restrictions
Linux	RH-8 RH-9	Desktop, Laptop	Video is not supported. Networking support is basic.
Macintosh	OS X 10.3	Desktop, Laptop	Networking support is basic.
Windows	XP, XP/Tablet, 2000 98SE, 98	Desktop, Tablet Laptop	Built using VisualStudio-7 (.net). Wide range of media supported via platform media renderers.
WinCE	WinMobile 2003, PocketPC2002 PocketPC 2000	iPaq 4150 iPaq 3835 iPaq 3600	Only single audio channel is supported. Video is not supported. Networking support is basic.
Linux CE	?	Zaurus	Video is not supported. Player UI is minimal.

Table 1 *Overview of Platforms Supported by AMBULANT/1.0.*

SMIL Dialects Supported

The AMBULANT player supports the SMIL 2.0 Language profile, plus extensions for SVG animation. All versions of AMBULANT (Linux/Mac/Win32/WinCE/LinuxCE) support the entire feature set implemented in the player.

In addition to the full SMIL 2.0 Language profile, the player also provides support for the following SMIL dialects:

- *SMIL PSS-6/PSS-5/PSS-4*: various implementations of mobile SMIL support, as defined by the 3GPP mobile multimedia consortium;
- *SMIL Basic*: the baseline profile support for SMIL 2.0, as defined by W3C;
- *SMIL 1.0*: the original version of the SMIL language, as defined by W3C;
- *MMS 2.0*: the sub-SMIL version of the SMIL Language, as defined by OMG, the open multimedia alliance for low-end multimedia messaging handsets.

Note that, as discussed in the next section, the support for mobile SMIL does not include support for proprietary media formats; support is only provided for SMIL language functionality.

Media Support

The AMBULANT player supports all basic media types on all platforms, with the exception of video on PDA and some Linux systems. (These restrictions are due to the libraries available for these devices.) Proprietary media (such as RelaMedia and WindowsMedia proprietary formats) are not supported because of licensing restrictions.

Networking Support

The AMBULANT player provides basic support for networking on all implementations. In addition, under Windows, support is provided to RTSP via the Window media infrastructure. Restrictions on the FFMPEG library used for non-Windows platforms — in which RTSP support was disabled in the latest releases — precluded the testing of RTSP in the final AMBULANT 1.0 player. We expect that this issue will be addressed in a future release of FFMPEG and will then be integrated into a maintenance release of the AMBULANT player.

3.2 Project Deliverables

Software

The AMBULANT player was released in six incremental releases instead of the initially intended three releases. Table 2 summarizes the release name, the release date, the release format and the scope of the player releases.

AMBULANT/*G:* In the original project plans, we had anticipated only three project releases. At the start of the actual project work, it became clear that there was a need to position and profile the project in order to generate interest among the user community. In order to meet this need, we developed the AMBULANT/G release, which was a simplified version of the Oratrix GRiNS player. The AMBULANT/G release was a closed source distribution that was released under an Oratrix license.

Release Name	Release Date	Release OS	Release Scope
AMBULANT/G	August '03	Win32 (binary only)	Introductory release. Full SMIL 2.0
AMBULANT/M	October '03	Linux (bin+src) Mac OS X (bin) Win32 (bin) Linux PDA (src)	Initial Project Release; MMS-level scheduler; Images, plain text, single audio; No video; Initial PDA support (Zaurus)
AMBULANT/S	February '04	Linux (src) Mac OS X (bin) Win32 (bin)	SMIL 1.5 scheduler; Images, text, audio. Platform-based support for video.
AMBULANT/X	April '04	Linux (src) Mac OS X (src+bin) Win32 (src+bin) Linux PDA (src) WinCE PDA (bin)	SMIL 1.9 scheduler; Images, text, audio, video. Initial support for WinCE PDA. Initial support for linking/interaction.
AMBULANT/O	June '04	Linux (src) Mac OS X (bin+src) Win32 (bin+src) Linux PDA (bin+src) WinCE PDA (bin+src)	Project Candidate Player release. SMIL 2.0 scheduler, broad support for media, initial support for networking. First full source code release.
AMBULANT/1.0	June '04	Linux (src) Mac OS X (bin+src) Win32 (bin+src) Linux PDA (bin+src) WinCE PDA (bin+src)	Project final release.

Table 2 AMBULANT Player *Software Releases*

AMBULANT/*M:* The first 'real' release of an open source Ambulant player was the 'M' (or MMS-level) SMIL player. The 'M' release provided an initial project framework that was based on a simple version of the SMIL language. The player served as both an initial technology release and a framework release for the project licensing, storage and distribution components. The 'M' release was made near the end of October, 2003.

AMBULANT/*S:* The 'S' release provided a replacement SMIL scheduler that supported all of SMIL 1.0 functionality plus some advanced SMIL 2.0 extensions. It also provided support for improved media rendering, SMIL Layout and improved platform support. The 'S' release was made in early February 2004.

AMBULANT/*X:* The 'X' release provided an extended SMIL scheduler that supported essentially all of SMIL 2.0 functionality plus some advanced SMIL animation extensions. It also provided support for improved media rendering, SMIL hierarchical layout and platform support for WinCE. The 'X' release was made in mid April 2004.

AMBULANT/*O:* The 'O' release was created as a candidate final release of the AMBULANT 1.0 player. It provided a tuned scheduler, support for animations and transitions, comprehensive support for media and other SMIL language features. It was the first source-based release of the project for all platforms. The 'O' release was made in early June 2004.

AMBULANT/*1.0:* This was the project final release. It provides support for the SMIL 2.0 language and has support for the mobile variants of SMIL. The '1.0' release was made in July 2004.

Note that at the point that the AMBULANT/1.0 release was made, all previous releases were removed from the AmbulantPlayer.org web site.

SMIL Demonstrators

Our work on the AMBULANT player resulted in the publishing of the following seven SMIL test applications and functionality demonstrators described in Table 3.

Application	Purpose	Versions
Welcome	*Installation Confidence Test*	Desktop/PDA
NY Geo	*Initial MMS/SMIL-level Demonstrator*	Desktop/PDA
Birthday	*Advanced Timing/Media Demonstrator*	Desktop/PDA
Links	*Advanced Linking Tests*	Desktop
Flashlight	*Navigation Demonstrator*	Desktop/PDA
Euros	*Linking, Transitions Demonstrator*	Desktop
News	*Complex Application Demonstrator*	Desktop/PDA

Table 3 *SMIL Demonstrators and Applications Delivered*

Papers and Publications

Our work on the AMBULANT player contributed to the following 10 papers and publications:

[1] A. J. JANSEN, *MacPython Present and Future: The Road to World Domination*, in Electronic Proceedings, European Python and Zope Conference 2003, Charleroi, Belgium, June 25-27, 2003. Available at: `http://www.europython.org/2003/sessions/talks/slidespapers`.

[2] D.C.A. BULTERMAN, *Position Paper*, ACM SIG Multimedia Strategic Retreat, L. Rowe and R. Jain, editors, Berkeley, CA, October 31-November 1, 2003.

[3] D.C.A. BULTERMAN, *The Ambulant Annotator: Medical Multimedia Annotations on TabletPC's*. Proc. E-Learn 2003, Phoenix, AZ, November 2003.

[4] D.C.A. BULTERMAN, *Using SMIL to Encode Interactive, Peer-Level Multimedia Annotations*. Proc. of ACM DocumentEngineering 2003, Grenoble, France, November 2003, pp. 32-41.

[5] D.C.A. BULTERMAN and L. RUTLEDGE, *SMIL 2.0: Interactive for the Web and Mobile Devices*, Springer-Verlag, Heidelberg, May 2004.

[6] D.C.A. BULTERMAN, *A Linking and Interaction Evaluation Test Set for SMIL*. ACM Hypertext 2004, Santa Cruz, CA, August 2004.

[7] D.C.A. BULTERMAN, *Supporting the Production and Playback of Complex Multimedia Documents*. Workshop on Web Engineering 2004, Santa Cruz, CA, August 2004.

[8] D.C.A. BULTERMAN, J. JANSEN, K. KLEANTHOUS, K. BLOM, D. BENDEN, *The Ambulant Open Source SMIL 2.0 Player*, ACM Multimedia 2004, New York, Oct 2004.

[9] D.C.A. BULTERMAN, J. JANSEN, K. KLEANTHOUS, K. BLOM, D. BENDEN, *Ambulant: A Fast, Multi-Platform Open Source SMIL Player*, ACM Multimedia 2004, New York, Oct 2004.

[10] D.C.A. BULTERMAN, *Animating Perr-Level Annotations Within Web-Based Multimedia*. Eurographics Multimedia 2004, Nanjing University, China, 27-28 October 2004.

Each of these papers either discussed the architecture/implementation of the AMBULANT player or they described how AMBULANT supported aspects of CWI's multimedia research.

Presentations at Seminars, Conferences and Workshops

During the course of our work, 18 presentations were made (or have been submitted) at various seminars, conferences and workshops on the AMBULANT player. These included:

2003:

1. EuroPython 2003, Charleroi, Belgium, June; presentation; A. J. Jansen.
2. ACM SIG-MM Senior Strategic Retreat, U. Calif./Berkeley, USA, November; presentation; D.C.A. Bulterman.
3. Oregon State Health University, Portland OR, November; presentation; D.C.A. Bulterman.
4. E-Learn 2003, Phoenix, AZ, November; D.C.A. Bulterman.
5. ACM DocEng 2003, Grenoble, November; D.C.A. Bulterman.

2004:

1. Philips Research, Briarcliff, NY, January; presentation; D.C.A. Bulterman.
2. CeBIT, Hannover, DE, March; presentation; D.C.A. Bulterman.
3. CWI Software Engineering Research Seminar, Amsterdam, April; Presentation; D.C.A. Bulterman
4. W3C SMIL 2.1 Working Group Meeting, Amsterdam, May; presentation; D.C.A. Bulterman
5. W3C Timed Text Working Group, Amsterdam, May; presentation; D.C.A. Bulterman
6. Music and Technology Conference for Liberal Evnironments, Clinton NY, June; SMIL tutorial; D.C.A. Bulterman
7. Hypertext 2004 Tutorials, Santa Cruz CA, August; SMIL tutorial; D.C.A. Bulterman
8. Web Engineering Workshop, Santa Cruz CA, August; presentation; D.C.A. Bulterman
9. HyperText 2004, Santa Cruz CA, August; presentation; D.C.A. Bulterman
10. Japanese Society for Rehabilitation of Persons with Disabilities (JSRPD), Tokyo, Japan, September; presentation and workshop participant; D.C.A. Bulterman
11. SANE, Amsterdam, September; poster; D. Benden, K. Blom
12. ACM Multimedia 2004, New York, October; presentation; D.C.A. Bulterman and K. Blom.
13. EG Multimedia 2004, China, October; presentation; D.C.A. Bulterman

3.3 Results Acceptance and Impact for Future Work

The AMBULANT player project has had several goals. In addition to the production of a reference SMIL player for the community, the project has also served as a catalyst to help our research efforts on multimedia. Clearly, the full impact of the project can only be accessed after a substantial period of deployment of the final result. However, even the early versions of the AMBULANT player have generated interest from the research and development community.

In the sections below, we consider the impact of the AMBULANT player on research at CWI, at other research and development institutions, and in other research projects. We conclude with some statistics on the download of the AMBULANT player.

Use of the AMBULANT *player in CWI Research*

One of the primary intended uses of the AMBULANT player was to serve as a basis for future work at CWI. In 2004, the new research group Convergent Media Interfaces was started at CWI, with the charter to study network- and user-level integration of various types of media delivery platforms.

The use of the AMBULANT player at CWI is shown in Figure 1. The player is currently used in three projects:

- The Ambulant Annotator medical annotations project, in which time-variant medical annotations are encoded in a SMIL file and played on TabletPC's using the AMBULANT player;
- The PDC-3 (parallel and distributed computing) component of the BRICKS project, in which the AMBULANT player is used as the basis for experiments in network modelling and performance analysis for end-to-end distributed multimedia applications; and
- The *Passepartout* project, in which the AMBULANT player will be used to provide SMIL functionality in a home broadcast content enrichment project. The Passepartout project is new work that is performed in conjunction with INS-2 and with a consortium for 14 other partners in an ITEA European group.

In addition to these projects, the AMBULANT player will also be used as the basis for the evaluation of a formal scheduling and analysis model that will be produced together the members of CWI's SEN-3 group.

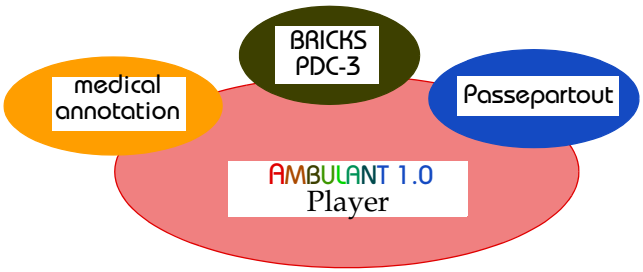


Figure 1. Use of the AMBULANT player at CWI.

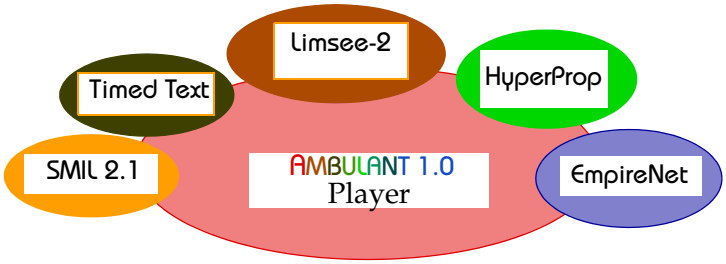


Figure 2. Use of the AMBULANT player outside of CWI.

Use of AMBULANT *in Other Research Outside of CWI*

Even in its early state of development, the AMBULANT player has been integrated into a number of external (non-CWI) research projects at leading academic and research institutions. Three of the existing projects that we know of are illustrated in Figure 2.

- The AMBULANT player is being used as an evaluation engine for the W3C SMIL 2.1 effort and as a prototype engine for SMIL 3.0;
- The AMBULANT player scheduler is being used as a timing engine for an implementation of W3C's new Timed Text format;
- In the Limsee2 project at INRIA (France), AMBULANT is used as a SMIL previewing engine for documents authored with the LimSee2 SMIL editor;
- In the HyperProp project at PUC-Rio (Brazil), AMBULANT is used as a deployment engine in early set-top-box experiments; and
- In the EmpireNet's SMIL pages, the AMBULANT player is used as the basis for multi-operating system SMIL player deployment.

Expected Future Use of the AMBULANT *Player*

There are several projects underway that are planning substantial use of the AMBULANT player. Most of these projects are at a non-public stage of development and discussion. Current projects under discussion with us include:

- *DAISY Consortium*: The Daisy Group makes players for the 'accessibility' market. Specifically, this group defines a standard for use with books for blind (or poor-sighted) users. We have begun implementation work on augmenting Daisy's internal SMIL core with the AMBULANT player.

- *Japanese Society for Rehabilitation of Persons with Disabilities*: This government-sponsored group has organized a workshop on SMIL for upgrading the hardware platforms mandated by the Japanese government for supporting talking books for the blind. The group expects to use the AMBULANT player in the device core.
- *National Center for Accessible Media (NCAM)/WGBH*: this organization is the primary captioning center for US public television. They would like to replace their use of the existing GRiNS player with the AMBULANT engine in the MAGpie captioning tool. In addition, they are investigating the use of the AMBULANT PDA player for distribution of captioned web presentations.
- *BBC Research*: The BBC is active in producing a new information captioning standard for capturing and distributing captions with their Web-produced programs. The AMBULANT player's Timed Text integration into the SMIL delivery platform will be used for captions development.
- *Sony Research*: The video authoring group in Tokyo is using AMBULANT as part of their editing suite tools for a new generation of professional multimedia media tools.
- *Manalee SMOX*: the (commercial) Manalee SMOX editing and authoring tool uses AMBULANT as one of its three SMIL preview players.
- *European Telecommunication Service Provider*: The research and standards departments of the largest EU Mobile service provider is investigating the use of AMBULANT as a platform for testing and evaluating MMS and PSS-6 mobile platform content.
- *Telecommunications Equirment Manufacturer*: The multimedia research group of the larget device manufacturer in Europe uses the AMBULANT player as a verification engine for SMIL 2.0 mobile profile documents.

We have also received requests from several other academic and research laboratories for joint work on SMIL development projects, but these are only exploratory at this point.

Download Statistics

We have looked at initial statistics from both the Source Forge site and our own AmbulantPlayer.org site to determine the popularity of the AMBULANT player. Here are some initial results. (Note that in each graph, the values for August are partial.)

- *General Statistics*:
  Figure 3 shows the general activity at the AmbulantPlayer.org project

pages hosted by CWI for the period September 2003-August 2004.

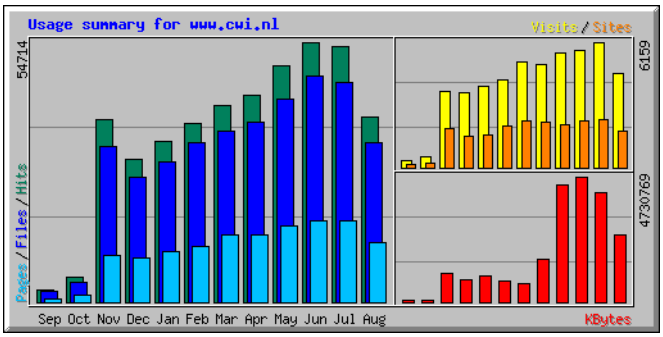


Figure 3. `http://www.ambulantPlayer.org` Activity Statistics.

Figure 4 shows the activities (page references and downloads) for project pages and software hosted at the Ambulant Source Forge project site.

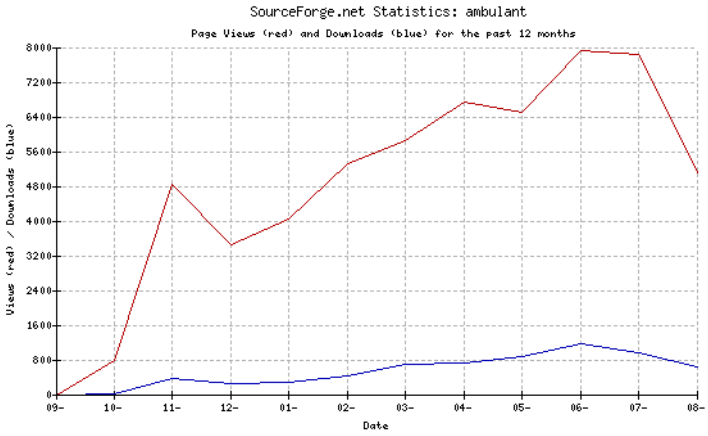


Figure 4. `http://www.sf.net/projects/Ambulant` Activity Statistics.

- *Total Player Downloads*:
  During the course of the project, over 6,976 copies of Ambulant distributions were downloaded (in the period Sept-July).
- *Player Platform Distributions*:
  Windows: 5,146
  Linux: 710
  Macintosh: 889
  WinCE: 231
- *Main Feeder Sites*:
  W3C
  Google/*

SVGX (references from the SVG community)
XmediaSMIL (SMIL Book Site)
EmpireNet (USA)
INRIA (FRANCE)

It is too early for a substantial analysis, but here are some impressions of the initial results:

- General Statistics: The project remains active and popular, with page views growing. The dramatic increase in download bytes is due to the publishing of the SMIL demonstrators. The AMBULANT player has been very popular in France, Germany and Japan
- Reference Sites: It is clear that our association with W3C on the W3C pages is a dominant factor in the attention given to the SMIL player.

3.4 Project Development Team

The initial intention of the AMBULANT player project was to assemble a project team that consisted of members from various research and development organizations, each contributing essential technology to the project. To our dissappointment, the actual effort provided by external partners has been limited. Part of this is due to the phenomenon that it is easier to promise resources than to deliver them, but we feel that a part of the problem was the large and technically complex task of providing a baseline SMIL player implementation. This being said, we were pleased with the efforts by INRIA (FR) and PUC-Rio (Brasil) to integrate the AMBULANT player into their projects, and we expect that other researchers can now make more incremental additions and improvements on the AMBULANT player source.

4 Financial Summary

Not supplied as part of the pubic report.

A Appendix: Player Features

A.1 Platform Requirements

System Requirements	Release 1.0	Notes
Operating Systems and HW:		
Linux Desktop	☑	
Windows Desktop (Win2K/XP)	☑	
PDA (Linux)	☑	*Subject to Media*
Pocket PC (WinCE)	☑	*Subject to Media*
Tablet PC (WinXP-T)	☑	
Mac OS-X	☑	
SunOS		*Only if done outside CWI*
Symbian Mobile		*Only if done outside CWI*
Other Mobile		*Only if done outside CWI*
Implementation Languages:		
C++	☑	*Implementation Base*
Java and/or Python	☑	*Bindings will be supported in 1.2*
Multimedia Codecs:		
Images (PNG, JPEG)	☑	*Proj std formats*
Images (Other)	☑	*May vary by platform*
Text (Plain, unformatted)	☑	*Use existing libs*
Text (W3C TimedText)		*Not yet avail. via W3C*
Text (HTML)	☑	*Win32 DT+TC only*
Audio (local wav/aiff)	☑	*Via existing open source*
Audio (local mp3)	☑	*earlier on WIn32/Mac*
Audio (streamed)	☑	*PDAs in 1.1*
Audio (AMR/mobile)		*Open codecs not avail*
Video (local mpg/divX)	☑	*Earlier on W32/Linux DT*
Video (streamed mpg)	☑	*Earlier on W32/Linux DT*
Video (mp4)	☑	*Check for L0 availability*
Animation (SVG)	☑	*SMIL Animation part*
Animation (Flash)	☑	*Win32 only*
Network Support:		
Local	☑	
Net/Streaming (RTP/RTSP)	☑	
Net/Non-Streaming (HTTP)	☑	
Net/Mobile Setup & Xfer		*If done outside CWI*

Table A-1: AMBULANT System Requirements

A.2 SMIL Requirements

SMIL Requirements	Release 1.0	Notes
SMIL Dialects Supported:		
Full SMIL 2.0 Language	☑	*All of SMIL 2.0, as GRiNS*
3GPP / PSS-3 Mobile	☑	*Including limitations*
3GPP / PSS-4/5/6 Mobile	☑	*Depends on when avail*
MMS	☑	*Strict MMS subset only*
SMIL Basic (W3C Spec)	☑	*No longer really relevant*
SMIL DOM		*If done outside CWI*
XHTML+SMIL (XSS)		*If done outside CWI*
Presentation Parsing and Import:		
SMIL 1.0	☑	
SMIL 2.0	☑	*Full support*
GRiNS	☑	*Support namespace*
MMS	☑	
MPEG-4 XMT		*If done outside CWI*
Device Profiles:		
Using GRiNS Profile Spec	☑	*Basic Support*
Using Capability Negotiation		*Outside scope of V1*
Player Emulation:		
GRiNS SMIL 2.0	☑	*Incl Profile extensions*
RealOne	☑	*Incl streaming extentions*
Nokia Mobile		*If done outside CWI*
Sony/Ericsson Mobile		*If done outside CWI*
Player UI Controls:		
Start/stop/pause	☑	*Basic UI Support*
Interaction via excl & events	☑	*partiak W32 UI first*
Interaction via links	☑	*all-platform support*
Variable speed (FF/REW)		*If time*
Direct Clock Manipulation		*If time*

Table A-2: SMIL Requirements

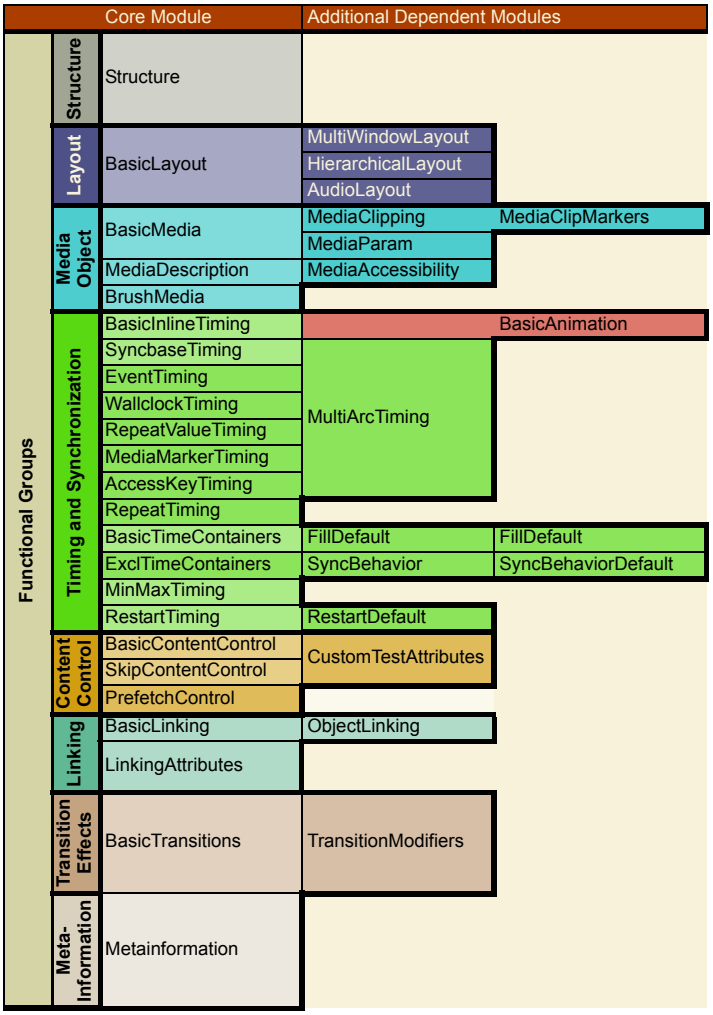
A.3 Performance and Architecture

Performance/Architecture Requirements	Release 1.0	Notes
Core SMIL Performance:		
Fluid Local Performance	☑	*Non-streaming local I/O*
Fluid Streaming Performance	☑	*Streamed via RTP/RTSP*
Fluid Transitions	☑	*For basic 6 transitions*
Fluid Interactive (excl)	☑	*For mouse-related events*
Fluid Hypermedia (linking)	☑	*Initial performance*
Fluid Animation	☑	*SMIL Animation only*
Replaceable Component Arch:		
Scheduler	☑	*(*
Content Control engine	☑	*Static vs Dynamic ctl*
Animation Engine	☑	*In architecture*
Prefetch Module	☑	*In architecture*
Layout Module	☑	*In architecture*
Data Source Support	☑	*In architecture*
Plug-in Components Arch:		
Media codec API	☑	*Via API*
Media rendering engines	☑	*Via API*
Netscape/IE plug-in support	☑	*via Java interfaces*

Table A-3: Performance/Architecture Requirements

A.4 Ambulant 1.0 Player SMIL Module Coverage

The 1.0 release represents the final project release. It supports the full SMIL 2.0 Language Profile module set, modulo bugs.



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