# Developing Web Applications with COLLADA and X3D

A Whitepaper

Dr. Rémi Arnaud
Sony Computer Entertainment

Tony Parisi
Media Machines, Inc.

March 25, 2007

COLLADA and X3D are two royalty-free open standards that use XML schema technology to represent 3D content. With the growing pressure for tool vendors and content providers to use open standards rather than closed proprietary formats, many are wondering which standard they should implement.

This whitepaper is intended to assist developers in understanding the similarities and differences between COLLADA and X3D, the design goals that informed their development, and how and where the two standards are used in practical applications. Rather than making a decision between the two technologies, many implementers will find that COLLADA and X3D can be used together as a powerful tool set for developing their Web and enterprise applications.

The authors– Rémi Arnaud, founder of the COLLADA initiative, and Tony Parisi, co-creator and editor of the X3D specification– share a deep conviction that open standards play a critical role in the development of modern software applications. It is our mutual goal that, taken together, COLLADA and X3D comprise the foundation for creating rich 3D applications and content that pass the test of time.

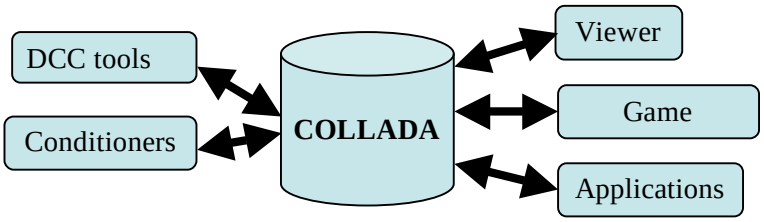
## Comparing COLLADA and X3D

COLLADA and X3D have developed along parallel tracks over the last several years. While the two standards have superficial similarities—both are technologies for representing structured 3D data in XML—they are quite different in their design goals and intended use.

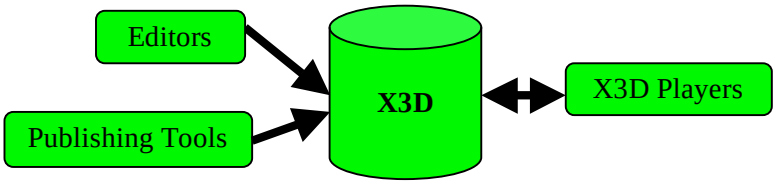
COLLADA focuses on the toolchain that brings content and assets from diverse authoring tools to an application, currently targeting principally the game industry. ***COLLADA is an intermediate format*** whose primary goal is to represent rich data in multiple forms, to enable the transformation of assets as they journey from content tools that use higher level description paradigms to applications that require platform-specific optimized descriptions.

X3D focuses on the visualization of 3D assets within applications. X3D has principally been targeted for the Web (thus the name and focus of the Web3D Consortium). ***X3D is a delivery format*** intended to contain the information needed for interactive applications. X3D specifies behaviors and interaction, and it includes both a specific ***run-time model*** that enables picking, viewing, navigation, and scripting, and an API to manipulate the scene graph at run-time.

COLLADA is the format of choice for Digital Content Creation (DCC) tools, for conditioning tools, and for archiving rich content. COLLADA enables the free exchange of asset data, enabling developers to construct an authoring pipeline from multiple tools. COLLADA can provide the content required for compelling X3D applications, in much the same way that it can carry and process the content for game applications. X3D is a *lingua franca* for delivering interactive 3D Web and enterprise applications that require real-time delivery of 3D data, ranging from online advertising and gaming, to virtual worlds and social networks, GIS and mapping, CAD, military simulation and medical visualization.




**COLLADA: Intermediate Format of Choice**




**X3D: Universal Delivery Format for Web Applications**

Figure 1. Comparison between COLLADA and X3D

The comparison between COLLADA and X3D is illustrated in Figure 1. X3D occupies a position in the production pipeline much farther downstream than COLLADA. Also, X3D picks up where COLLADA leaves off: COLLADA defines the format for 3D assets but not their runtime semantics, leaving that job to the application writer.

In the game industry, that would be the end of the standards story - where assets are imported into a proprietary engine used to deliver a specific game. In other domains, this is where the story just begins. For many applications, writing a new engine from scratch is not only wasteful, but cost-prohibitive. X3D provides flexible run-time power out of the box, together with the programmability required to build serious applications. X3D is also ideal for the Web, because it has complete integration with web-based data formats, supports DOM and Ajax programming, and was designed with streaming web delivery in mind.

## Using COLLADA For X3D Web Applications

The following figure illustrates a typical COLLADA toolchain, used to provide content to X3D applications. COLLADA is feature rich and contains most of what is needed by X3D applications, but it is necessary to use X3D specific tools to create the specific application behavior. If for some reason it is necessary to convert X3D back to COLLADA, it is even possible to keep this additional information as <extra> information within COLLADA using the built-in extension mechanism for application-specific data.

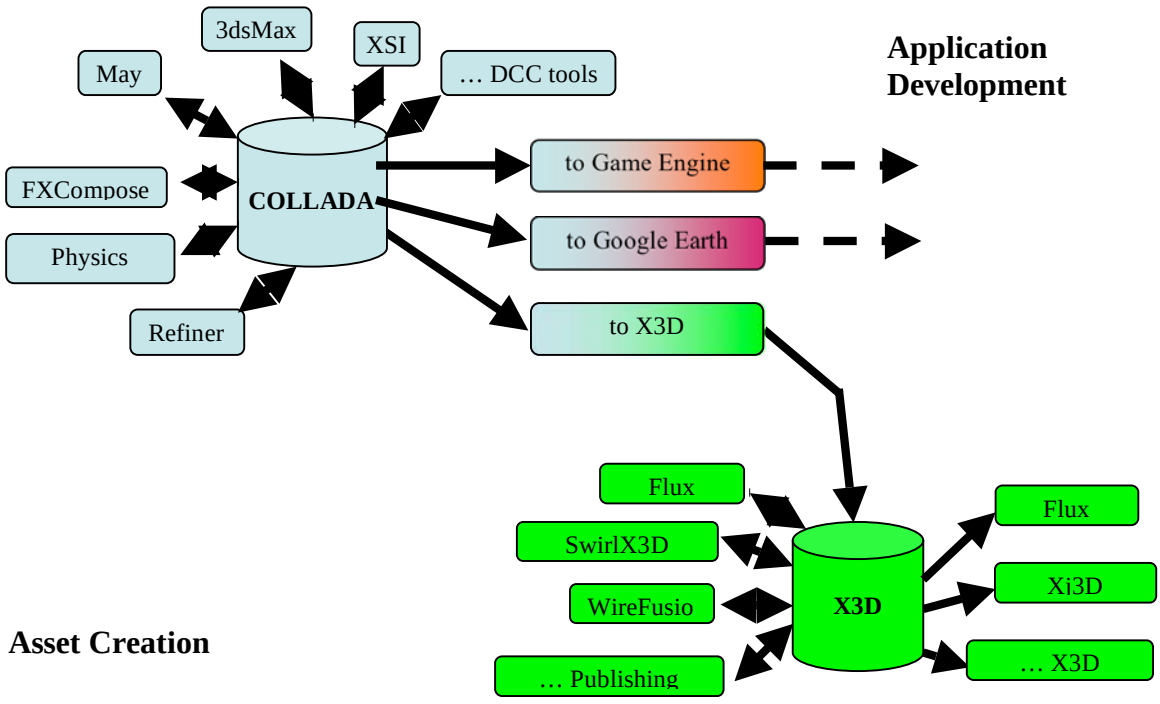



Figure 2. A Typical Web Pipeline Using COLLADA and X3D

Thanks to the existence of quality COLLADA-to-X3D converters, COLLADA is already being used in this manner for Web3D applications today, such as the novel "mashup" between Google Maps and 3D models depicted in Figure 3.

Media Machines developed this mapping demonstration using the COLLADA importer built into its Flux Studio authoring software. The models used in this application were originally authored in Google Sketchup, exported to COLLADA KML (Google Earth format), and then uploaded to the Google 3D Warehouse. From there, the COLLADA models were imported into Flux Studio, where animation and interactivity were added, and then published to an X3D application that uses client-side Ajax programming and runs in Flux Player. The result is an application that can view COLLADA models originally created for Google Earth, but running within a standard Web page.


Figure 3. A Sample 3D Web Application Using COLLADA
Image Courtesy Media Machines, Inc.

## COLLADA or X3D – Which Should I Use?

The information in this paper should help you to choose which standard—COLLADA or X3D—to use for your application. Your application might need only one of the two; some may need both. The following examples illustrate some typical scenarios.

**Example 1.** Your application is a content-creation tool and you want your users to be able to develop assets for many markets. In this case, COLLADA is the appropriate choice. If in addition you want to target X3D run-time systems with value-added features such as interactivity, you may also want to implement support for X3D standards directly rather than going through an additional conversion. Typical applications include DCC tool such as 3dsMax, Maya, and Softimage.

**Example 2.** Your application is a content-editing tool targeting 3D Web publishing. In this case you would implement only the X3D format. Typical applications include Flux Studio, WireFusion, and SwirlX3D.

**Example 3.** Your application is a run-time application that can take advantage of the X3D run-time model. You use X3D directly, and use an X3D player as your application engine. Typical players include Flux Player, FreeWrl, and Xj3D. These applications can also directly load COLLADA content, if it makes sense to display content on the Web without any run-time interactivity, or use the COLLADA asset as an embedded object within a larger application (an X3D object type known as an "Inline").

**Example 4.** Your application is a run-time application that requires its own specific run-time. In this case, use COLLADA in your toolchain, and create a COLLADA -> "Your Format" converter at the end of the toolchain. Typical applications include video games.

**Example 5.** Your application is a run-time application that does not need to support X3D run-time specifics, but needs to be able to accept content from a variety of sources. In this case, directly load COLLADA in your application; you do not provide an off-line converter. Typical applications include Google Earth.

## COLLADA and X3D – An Ongoing Collaboration

COLLADA and X3D are industry standards with broad support that leverage thousands of man-hours of expertise and experience in a range of fields including Computer-Aided Design, Visual Simulation, Animation, Virtual Reality, the Web and the Internet. This whitepaper was prepared by two of the thought leaders in these technologies, as part of an ongoing effort to ensure that COLLADA and X3D not only interoperate, but provide significant long-term value to content and application developers world wide.

The COLLADA effort is focused on the quality and the completeness of support from the DCC tools, as well as on increasing the number of tools accepting this standard. The X3D development community can now take advantage of all this technology, and save considerable effort by focusing on good quality COLLADA-to-X3D converters such as CX2 from Pinecoast Software and DAE2X3D from Media Machines.

The COLLADA toolchain is used in more and more domains, and its feature set is growing accordingly. To improve this content pipeline, it will be advantageous to avoid any cosmetic conversion between COLLADA and X3D for any data that is mainly identical. To that end, the COLLADA and X3D teams have begun to identify areas where entire parts of one standard might be adopted for use directly within the other. For instance, because COLLADA has already added Physics to its specification, and several tools are already capable of providing such content (Maya, Max, AGEIA, Bullet), the X3D and COLLADA groups are now collaborating so that physics specifications are almost identical. Ideally, in the future, since both COLLADA and X3D are based upon XML, X3D might be able to directly accept COLLADA content without any conversion.

**For More Information**

For information on COLLADA and the Khronos Group, please visit the COLLADA and Khronos Web sites at www.collada.org and www.khronos.org.

For information on X3D, please visit the Web3D Consortium Web site at www.web3d.org.

The authors may be contacted at the following email addresses:

remi@collada.org
tparisi@mediamachines.com

The authors encourage questions and feedback on this whitepaper.

**Trademarks:**

COLLADA is a Khronos Group standard. Khronos is the home of OpenGL and many other media-related APIs. COLLADA was created by Sony Computer Entertainment as an open technology to help game developers' content creation needs. Control of COLLADA was transferred to Khronos in January 2006 after two years of development.

X3D is a standard created and promoted by the Web3D Consortium. X3D was born of the need to create a modern evolution of the VRML standard. As part of that evolution, X3D incorporates an XML-based representation, making it an ideal system for deploying 3D applications for the Web and in the enterprise. VRML was ratified as an International Standard by ISO in 1998, and is fully compatible with X3D. X3D was ratified as an International Standard by ISO in 2004.