Extensible Modeling and Simulation Framework
Extensible 3D Graphics (X3D)

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with
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Alan Hudson, Web3D Consortium & Yumetech Inc.
David Colleen, Planet 9 Studios
Carol Wideman, VCom3D Inc.
Establish national, global technical agenda for standards-based simulation on the Web

- Object Management Group (OMG)
- Open GIS Consortium (OGC), Chuck Heazel, chair
- Simulation Interoperability Standards Org. (SISO)
- Web3D Consortium

• When: October 27-30, 2003

• Where: right here!

• Hoped-for Outcomes:
  • Improved, shared knowledge of capabilities
  • Collaboration activities, bigger market capabilities, policy
Topics

- XMSF overview, work-to-date synopsis
- X3D overview
- XMSF Partners: GMU, SAIC
  - Show floor demos: Yumetech, Planet 9, VCom3D
XMSF Overview
XMSF Definition

The Extensible Modeling and Simulation Framework (XMSF) is defined as a set of Web-based technologies, applied within an extensible framework, that enables a new generation of modeling & simulation (M&S) applications to emerge, develop and interoperate.

Current work in Web Services appears to be an appropriate basis for organizing and composing the many necessary capabilities of Web/XML and Internet/networking needed for M&S applications.
XMSF
Technical Challenges Workshop

Monterey California USA, 19-20 August 2002
- preceding annual NPS MOVES Open House

Goal: initial technical survey and assessment
- Modeling & Simulation via Web technologies feasible?
- XMSF white paper provided basis for discussion
- Report back to this group for strategic planning

Diverse technical experts invited
- Web/XML, Internet/network, Modeling & Simulation
- Point papers for undiluted snapshot of key ideas
XMSF Symposium summary

Friday 6 September 2002, GMU Fairfax Virginia

Keynote address by Anita Jones: 
“Modeling & Simulation is next killer app for Web”

Diverse speakers presented their considered opinions, in reaction to the workshop whitepaper
• Across-the-board support for XMSF goals
• Recognition: all need shared Web approach
XMSF motivations

**Web-based technologies** can provide an extensible modeling and simulation architecture, to support a new generation of interoperable applications.

Simulation support is needed for operational warfighting capabilities.

XML-based architecture can provide a bridge between emerging rehearsal/reality/replay requirements and open/commercial Web standards.

**Web = best tech strategy + best business case**
Problems

Current approaches are not compatible with effective use of emerging Web technologies

Military modeling & simulation has little or no apparent impact on warfighters’ daily tactical operations

Diverse simulations do not scalably interoperate with warfighting systems

Global systems are not yet possible without connection to common interoperable framework
  - physical and logical “stovepipes” prevent this
Observations

Significant agreement, consensus on principles

Web technologies for networked modeling & simulation appears to be feasible

Lots of different ideas about how to execute
- few (if any) contradictions
Conclusions

Close working relationship across all three component areas will continue to be needed:
- Web Technologies / XML, Networking, and M&S
- Benefit from broad technical insights
- Interrelated goals and concerns

XMSF concept must continue to be refined from a high-level concept to definitive technical recommendations, practices, and applications.
Conclusions

Need exemplar applications identified, initiated
- Collectively and clearly demonstrate the application potential of XMSF concepts
- A number of existing and emerging programs were discussed as possible contexts for the exemplars

Web Services appear are promising area for focusing future work
- synopsis to follow
Conclusions 5

Security concerns are cross-cutting for all areas, must be addressed throughout design process

- or unforeseen vulnerabilities occur
- Approximately equal number of Web-related technical challenges & solutions presented
- Likely feasible but recurring throughout lifecycle
- Independent of classical physical/military security
Web Group summary

Many issues to consider, listed in workshop report, group notes and individual point papers

W3C has done the heavy lifting already, there are many languages and specifications which work well together today

Web Services architectures: promising approach to organize all this capability in an actionable way
## Web Services

<table>
<thead>
<tr>
<th>Repositories</th>
<th>Administrative</th>
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<tr>
<td>Where approved services reside</td>
<td>Exemplar: DoD XML Registry</td>
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<tr>
<th>Services Discovery</th>
<th>UDDI, LDAP</th>
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<tr>
<td>Publish, search capabilities</td>
<td>Universal Description, Discovery Integration, Lightweight Directory Access Protocol</td>
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<tr>
<th>Services Description</th>
<th>WSDL</th>
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<tr>
<td>Detailed methods, parameters</td>
<td>Web Services Description Language</td>
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<tr>
<th>XML Messaging</th>
<th>XML-RPC, SOAP, XMLP</th>
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<td>Simple XML encoding/decoding</td>
<td>Remote Procedure Calls, XML Protocol</td>
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<tr>
<th>Service Transport</th>
<th>HTTP, SMTP, FTP, BEEP</th>
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<tbody>
<tr>
<td>Move messages between apps</td>
<td>Transfer is independent of messages</td>
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XMSF mailing lists
http://www.movesinstitute.org/mailman/listinfo

xmsf-announce
Announcements related to XMSF

xmsf-discuss
Ongoing discussions regarding XMSF

xmsf-webservices
Web services for modeling & simulation

xmsf-xdv-developer
XMSF DCEE Viewer (XDV) development

savage-announce
Scenario Authoring and Visualization for Advanced Graphical Environments
Prepared for change, real projects

Technical Challenges Workshop
- NPS, August 19-20, focused expert efforts

Strategic Opportunities Symposium
- George Mason University, September 6 2002
- Broader feedback: right track? what else is needed?

Exemplar Demonstrations
- I/ITSEC demos, Orlando Florida December 2-5 2003
- Next:

Early Adopters Workshop
- SAIC, McLean Virginia, February 2003

Simulation Interoperability Workshop (SIW) … ongoing
- Panels, papers, outreach, Orlando Florida April 2003
- Next:

XMSF Participation Workshops: … ongoing
- JFCOM/ODU, Suffolk Virginia May 2003

Web-based Modeling and Simulation Workshop: OMG, OpenGIS, Web3D, SISO
- Crystal City October 27-30 2003  http://www.websim.net

Next steps for XMSF …
- Continue partnership projects with collaborators + sponsors
- Demonstrate use of multiple connected Web Services in working exercises
IITSEC 2003


Orlando Florida, 1-4 December 2003

2002 attendance total: 17,000
2002 MOVES-booth visitors: 3,000
IITSEC 2003 Themes

XMSF enables:

- Shared scenario, common operational picture
- Shared use of diverse Web Services
- Hooks for diverse legacy middleware APIs
  - HLA/RTI, COE, DIS, CORBA, MDA,
  - GIG, GRID, Semantic Web, etc.
XMSF Booths at IITSEC 2003

ODU VMASC + JFCOM

SAIC

NPS MOVES
- Savage XMSF projects
- America’s Army
- GMU
- Planet 9 Studios
- Yumetech Inc.
- Web3D Consortium

VCOM3D human animation

DMSO
IITSEC: What Web Services?

Glue technologies
- Web-enabled RTI
- SAVAGE model library
- DTED terrain server
- XML-based Tactical Chat
- DIS over SOAP (maybe)

Ontologies (tactical vocabularies)
- Battlespace Management Language (BML)
- NATO Battlespace Generic Hub (BGH)
Iraq database queries produce terrain, features, cartography viewer. Database-generated and queriable.
Tactical ontologies

XML provides syntax and validatibility
Web Services provides messaging capability
Still: consistent semantics needed for joint ops
NATO Battlespace Generic Hub (BGH) is candidate vocabulary of entities, relationships
So is Battlespace Markup Language (BML)
  • Hey! Shared semantics! What great progress!
NPS has shown autogeneration of virtual battlespace from XML operations order
  • More is possible and needed
Generic Hub Design Methodology for Battlespace Visualization + Semantics:
DoD-wide Autoconversion Of Operation Orders into 3D Virtual Environments

Typical Operation Order: hand-crafted “Word Document”

USMTF Message: Modified Operation Order

XML-MTF free-text Operation Order

Operation Order: GH4 Modified XML-MTF

Generic Battlespace Schema for Common Operational/Tactical Picture (COP/CTP)

Generic Hub version 4 (GH4) Information Exchange Data Model

X3D/VRML World: Amphibious Operation Order Displayed as Networked, Animated 3D Scene!

XSL Style Sheets Transform OPORD

XML-MTF converted to X3D/VRML

XSL Style Sheets Transform OPORD

XML-MTF converted to RDBMS Data Fill

GH4 Coalition Operational Context Database

Operational Context for the Global Information Grid: Smarter Applications, Agents, Autonomous Systems

Points of Contact: Erik Choum NUWC ChoumE@tpt.nwsc.navy.mil - Francisco Lopez IDA FLopez@ids.ida.org - Eugene Simitse IDA GSimitse@ids.ida.org - Dan Brustman, Shanae Nicklens, Doug Horner NPS Dbrustman@nps.navy.mil 13 September 2001
Future Messaging via Web Services and Extensible Modeling and Simulation Framework (XMSF)

Extend systems with XML directly to Tactical Markup Language (tml) and oporder/MTF messaging.

XML Transformation

Direct Mapping of BGH-ARM to BGH-TML captures all entities and preserves database oriented referential links. This allows extensibility while maintaining interdatabase connectivity capability.

The BGH-TML is restructured to more accurately reflect the LC2IEDM Key Entity relationships in an XML-friendly (i.e. efficient) way.

C4I Software
- Simulations
- Combat Systems
- Training
- MTF-XML

Extend systems with XML directly to Tactical Markup Language (tml) and oporder/MTF messaging.

Future Messaging via Web Services and Extensible Modeling and Simulation Framework (XMSF)
Extensible Modeling and Simulation Framework (XMSF)
Web3D Consortium Working Group Charter

Background. The Extensible Modeling and Simulation Framework (XMSF) is defined as a set of Web-based technologies, applied within an extensible framework, that enables a new generation of modeling & simulation (M&S) applications to emerge, develop and interoperate. Specific subject areas for XMSF include (a) Web/XML, (b) Internet/networking and (c) modeling & simulation (M&S).

The Web3D Consortium XMSF group is building public-domain software and content that shows how to use Extensible 3D (X3D) graphics with Web Services in a standards-based XMSF framework. Web Services appear to be the best technical approach and best business strategy for large-scale progress.

Goals

The objectives for the XMSF Working Group include the following.

- Build compelling exemplar 3D worlds and applications, exercising the full range of X3D and XML-based Web capabilities
- Native integration of X3D graphics generation and rendering over the full range of client, server and peer-to-peer networking
- Adapting the DIS protocol for use in SOAP messages to further extend Web Service capabilities
- Public demonstrations of XMSF capabilities at IITSEC, SIGGRAPH, Web3D Symposia, SISO Simulation Interoperability Workshops, etc.
Extensible 3D (X3D) Graphics
Extensible 3D (X3D) Graphics

Next-generation XML-ized version of Virtual Reality Modeling Language (VRML)
Scalable Web-based 3D graphics
Open standard under ISO review
Process driven through open nonprofit Web3D Consortium
- http://www.web3d.org/x3d.html

Partners World Wide Web Consortium (W3C)
- http://w3.org
What is X3D?

Extensible 3D (X3D) Graphics

- Virtual Reality Modeling Language (VRML) updated
- Third-generation ISO specification
- Both XML and .wrl encodings, compatibly

Deliverables

- Specification updates, with compatible XML tagset
- Multiple implementations, including open-source
- Scene Access Interface (SAI) strongly typed API
- Conformance suite and examples
- Authoring capability: X3D-Edit, using XML for XML…
Further X3D motivations

Authoring is hard, “Content is King”

- X3D is not competing with specialty formats, instead provide common interoperability/interchange
- Strong validation checks eliminate most authoring errors before content escapes
- Plays well with next-generation Web languages

“3D hardware problem” is already solved 😊
XML in 10 Points
http://www.w3.org/XML/1999/XML-in-10-points

XML is for structuring data
XML looks a bit like HTML
XML is text, but isn't meant to be read
XML is verbose by design
XML is a family of technologies

XML is new, but not that new
XML leads HTML to XHTML
XML is modular
XML is basis for RDF and the Semantic Web
XML is license-free, platform-independent and well-supported

500+ member companies and institutions in World Wide Web Consortium (W3C) already understand their business case.
This comprehensive suite of X3D and VRML software provides a huge range of viewers, content, tools, applications, and source code to enable the further development of X3D-aware applications and content.

The Web3D SDK offers something for all graphics persuasions from green to guru - from the beginner, viewing their first Web3D world, to real-time 3D developers and application programmers looking for the latest prototypes and source code.

http://sdk.web3D.org

The Web3D Consortium appreciates the support of the Communications Research Centre of Canada and Sun Microsystems in the production of this Software Development Kit.
Internationalization (i18n)

XML makes internationalization feasible and practical.

Example: X3D tooltip hints are manually translated
- Scene files unchanged, no difference in node tags or field attributes
- Wow!

Available: Chinese, English, French, German, Spanish
- Others promised, volunteers are welcome and helped
- Provide customized X3D-Edit tools
- Provide customized tooltip reference sheets
### Anchor

Anchor est un nœud pouvant comporter la plupart des nœuds. Le fait de chauffer sur une géométrie ancrée lance le contenu dont l’adresse est spécifiée dans le champ `url`. Conseil : insérez un nœud `FormField` avant d’ajouter une Geometrie ou une Apparence.

### DEF

```xml
<DEF ID="#IMPLIED">DEF permet de définir un nœud spécifique pour ce nœud, référencable par les autres nœuds du même type.
</DEF>
```

### USE

```xml
<USE ID="DEF="#IMPLIED">USE signifie une réutilisation des attributs et des nœuds enfants appartenant à un nœud prédéfini par DEF, ignorant alors les autres attributs et enfants. Conseil : utiliser USE pour dupliquer une géométrie (au lieu de copier/coller les nœuds) peut améliorer les performances. Attention : PAS mélanger DEF (ou autres autres valeur attribut) lorsque vous utilisez l’attribut USE !
</USE>
```

### description

```xml
[[description exposedField type="String" CDATA="#IMPLIED">description peut comporter du texte qui sera affiché par l’explorateur pour décrire ce lien. Conseil : utilisez `xref` pour remplacer automatiquement les caractères références XML si besoin (comme `&amp;#38; pour &; ou &amp;#34; pour "), écrivez donc ce que vous voulez. `Conseil : ce champ peut être ignoré.
</description>
```

### url

```xml
```

### parameter

```xml
```

### bboxCenter

```xml
[[bboxCenter field type="Vector3Float" CDATA="#IMPLIED">Bounding box center position décalée de l’origine du système de coordonnées local.
```

```xml
```
CALL FOR PAPERS

Web3D 2004 Symposium

9th International Conference on 3D Web Technology
TENTATIVE Web3D 2004 Symposium Dates: April 6-9, 2004
Monterey, California, USA

http://www.web3d.org/s2004

Sponsored by
ACM SIGGRAPH and the WEB3D CONSORTIUM

Ninth in a series, the Web3D 2004 Symposium will focus on every aspect of 3D technologies on the Internet, ranging from languages, tools and high performance 3D graphics to human-computer interaction issues and the latest mobile applications. The annual Web3D Symposium is a major event in the Web3D community which unites researchers, developers, experimenters, and content creators in a dynamic learning environment. Attendees share and explore methods of using, enhancing or creating new 3D web technology such as X3D, VRML, MPEG4, OpenHSF, and Java3D.

http://www.web3d.org/s2004
NPS demonstration projects
Anti-terrorist force protection

12 October 2000: Aden Harbor, Yemen
Al Qaeda attack on USS COLE (DDG 67)
USS COLE attack by Al Qaeda

0736C COLE BEGINS HARBOR TRANSIT

12 OCTOBER 2000

SUSPECTED TERRORIST BOAT 0849C COLE MOORED
ENTRY POINT 1031C COMMENCED FUELING
1115-1118C ATTACK

"LITTLE ADEN"
LOCATION OF TERRORISTS DURING ATTACK PREPARATIONS

REFUELING DOLPHIN #7 (SITE OF ATTACK) 12-47.54N 044-58.55E

01:32:21
Course 171, depth 0m Location 27838 11165

01:28:25
Course 171, depth 0m Location 27838 11167
agent-based simulation of terrorists and friendlies
Anti-terrorist force protection scenario, Pearl Harbor Oahu
Savage

Scenario Authoring and Visualization for Advanced Graphical Environments

The SAVAGE group is building a large archive of dynamic 3D military models and authoring tools using Extensible 3D (X3D) graphics.

Zip archive

21 Sections, 85 Chapters, 704 Models

Aircraft Fixed Wing
- AV 8B - Harrier - United States
- My 22 - Osprey - United States
- Bear - Russia
- B 3 Orinn
- F 18 - Blue Angel - United States

Aircraft Helicopters
- AH 1 Super Cobra - United States
- CH 46 E - Sea Knight - United States
- CH 53 - United States
- M 26 Prowler - United States
- Helix - Russia
- OH 58 D - Kiowa Warrior - United States

Aircraft Miscellaneous
- Balloon
- Blimp
- Zeppelin

Amphibious Vehicles
- AAAV
- AAV
- LCAC

Biologies
- Dolphin
Sonobuoy field visualization

SH-60B Seahawk orbit
00:07:39, course 315, pitch 0
location -780 780, altitude 100m

SH-60B Seahawk orbit
00:03:57, course 135, pitch 16
location 5772 5228, altitude 191.3m
DTED Terrain viewer: selecting tiles
DTED Terrain viewer: 3D interface
Additional slidesets

Dr. Katherine Morse, SAIC

Dr. Mark Pullen, GMU
New Analytic Agenda for M&S

U.S. Navy OpNav N81
- LCDR Phil Pournelle, Campaign Analysis team

Composable Scalable Resolution for M&S
- Connect legacy models to new resources, in any combination
- Transform analysis economy to marketplace of ideas

Expose traditional analytic tools to Web Services
- SimKit Discrete Event Simulation (DES) library
- Naval Simulation System (NSS): theater-level M&S
- Explore extensible frameworks, using XMSF approach
Current Capabilities for WebSim

Tuesday afternoon session, October 28
Current Capabilities

Keynote: Web-Enabled Modeling & Simulation within Global Information Grid (GIG)
- Johnny Garcia, General Dynamics

Leveraging Full-Fidelity Simulations in a Web-Enabled Environment
- Christopher Cull CAE USA

Massively Multiplayer Games on the Internet
- Emmet Beeker, AT&T Government Solutions
Current Capabilities

Extensible Modeling & Simulation Framework: Enterprise and Visualization Perspectives
- Andreas Tolk, Old Dominion University VMASC
- Don Brutzman, Naval Postgraduate School

Advanced Application Needs: All of the Above
- David Colleen, Planet 9 Studios

Panel Discussion
Panel questions

Technical capabilities have arrived – hooray!
- Please confirm: any technical showstoppers?
- Are we “good enough” to reach the business case?
- Can we really connect via Web services?

Connecting standards consortia to government policy forums – how to engage?

Centering: what cross-cutting projects/products can best show our WebSim collaborations making markets, capabilities, $$, etc.
Contact

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## Contacts

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http://www.MovesInstitute.org/xmsf