



3D on the Web

Why We Need Declarative 3D

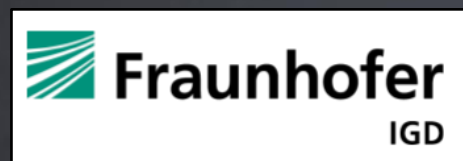
Arguments for an W3C Incubator Group

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Agenda: 3D on the Web

- **Why We Need Declarative 3D**
 - Philipp Slusallek, DFKI & IVCI
- **Overview of XML3D**
 - Kristian Sons, DFKI
- **Overview of X3DOM**
 - Johannes Behr, IGD
- **Open Discussion**
 - All of us

Executive Summary: 3D for the Web

- **3D graphics is hampered by limited availability**
 - 3D technology and games are everywhere
 - But sharing of 3D content is severely limited
- **Web allows sharing 3D content (just like video)**
 - Extend Web/HTML5 with *interactive 3D graphics*
 - Provide industrial-strength graphics capabilities
 - Provide space for innovation above OpenGL/DX
- **Need to adapt 3D graphics for the Web**
 - Must work for non-experts (its a *means*, not a *goal*)
 - Provide *easy 3D* for millions of Web developers
- ▶ **W3C: Important role for 3D on the Web**

Why Not Just Use ...?

- **VRML/X3D**

- Not compatible with HTML, separate format & files
- Many new and incompatible concepts
 - DAG vs. tree, own scripting (S/EAI), own event model, ...

- **Collada**

- Exchange format, not designed for interaction/Web

- **WebGL**

- *Low level API* only, hard on Web developers
- Not indexable or searchable
- Many new scene graph APIs, why not use the DOM?
- Limited to OpenGL ES 2.0 (2007), closely tied to HW

- ▶ **W3C: Declarative answer for 3D on the Web**

But What About Content Creation?

- **Video**
 - Easy: point & click with video camera/mobile phone
 - **3D Graphics**
 - Initial creation of a 3D model is hard
 - But computer vision research is making good progress
3D from images, laser scanners, depth cameras, etc.
 - Reuse of content is simple: *Network effect*
 - The more is available the easier it gets to create new
3D geometry, materials, lights, ...
 - Index & search becomes vital (needs indexable content)
- ▶ **3D should be in searchable Web documents!**

Motivation

- **Compare to Video Technology**
 - Technology had been there in the mid 1990ies ...
 - ... but nothing happened
- **Video on the Web: YouTube (2005)**
 - They allowed *anyone* to *easily* add video to the Web
 - Everyone could: **create, share, experience** video
 - Today: 2 billion views per day
 - Revenue of \$1.1 Billion (target for 2011)
 - ▶ **Can we repeat something similar for 3D?**

Motivation

- **3D graphics is becoming a commodity**
 - Embedded GPUs everywhere (e.g. mobile devices)
 - 3D stereo in movies, moving to consumer
 - High-bandwidth (mobile) Internet access
 - Client and server side/cloud rendering
- **But not easily usable for the Web**
 - Exclusively focused on games (plus some CAD, etc.)
 - Specialized content for specialized engines (and v.v.)
 - Needs skilled OGL/DX and content developers
 - ▶ **Need to adapt 3D graphics for Web**



New Market Opportunities

- **New cultural and social opportunities**
 - Virtual museums, eLearning, social interaction, ...
- **Novel entertainment and gaming markets**
 - Online worlds, 3D gaming, interactive “movies”, ...
- **Interactive product presentations**
 - Product catalogs, online configuration, tourism, ...
- **Collaborative engineering and interaction**
 - Product design, dual reality, production, marketing, ...
- **Visualization and interaction as a services**
 - 3D readily available and easy to use on any device

New Market Opportunities

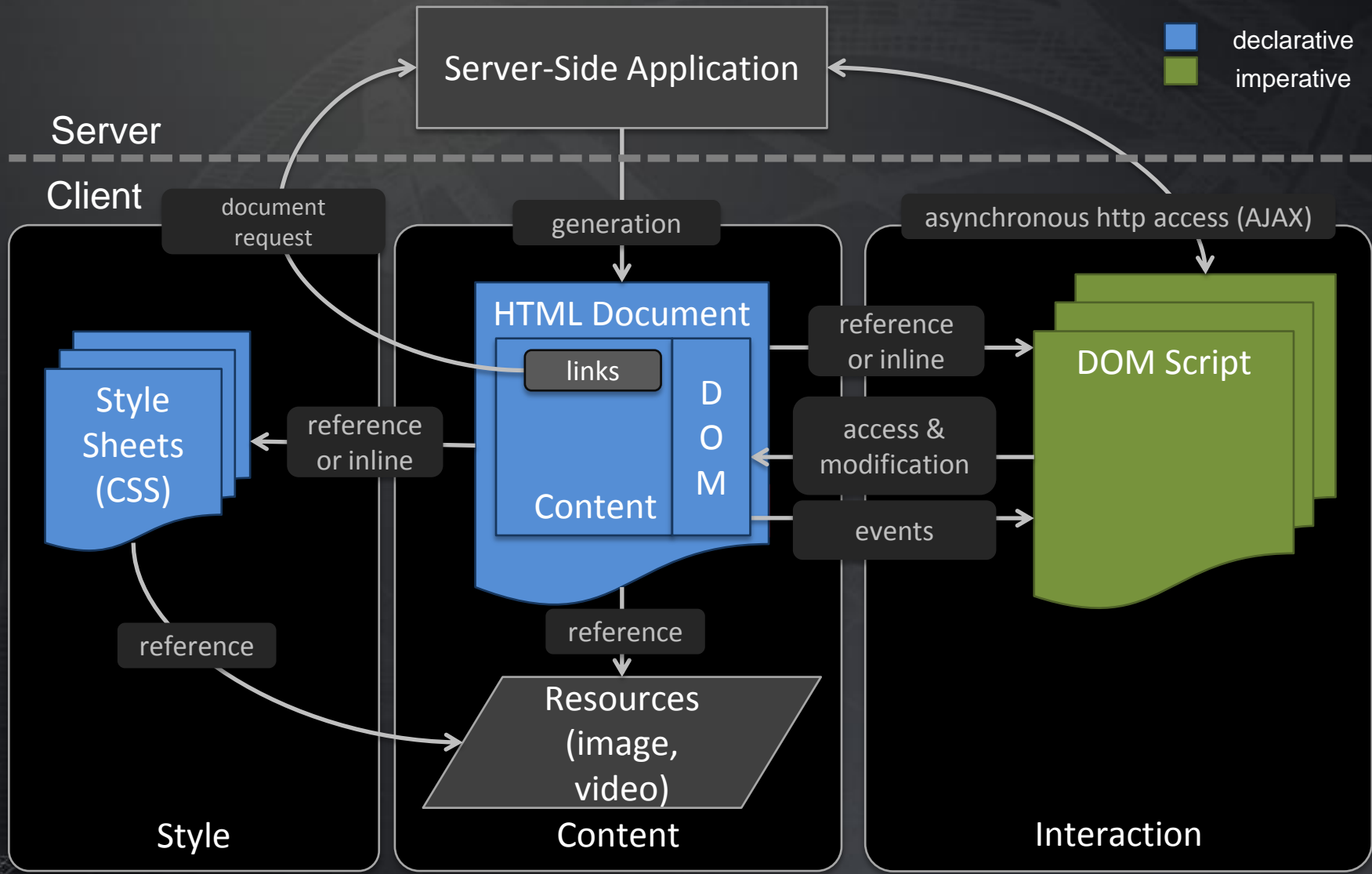
- Consequences

- New business cases (every user, every platform)
 - Needs many more developer
 - 3D-graphics a *means*, not an *end*
- Support “arbitrary” 3D content
 - Game engines not sufficient → industrial strength graphics
 - Developer and users expect things to “just work”
- Take advantage of millions of web developers
 - Reuse their skills: Merge graphics into web programming
- Integration with the rest of the Web technologies
 - Make 3D part of Web document/DOM (→ search, etc.)
 - Need semantics to go beyond pure graphics data

Proposal: Declarative 3D On The Web

- **Make it easy to add 3D to Web pages**
 - Fully integrate 3D content into HTML5 *documents*
 - Interactive 3D graphics as first class DOM objects
 - Reuse existing Web technology wherever possible
 - Avoid barrier to entry – make Web developers feel at home
 - Do not add new concepts, unless absolutely necessary
- **Jump start 3D on the Web**
 - Freely provide necessary technology
 - Specification of HTML extensions & standardization
 - Native browser & JS implementations, server side, ...
 - Tutorials, examples, hosting, ...
 - Joint initiative with research and industry

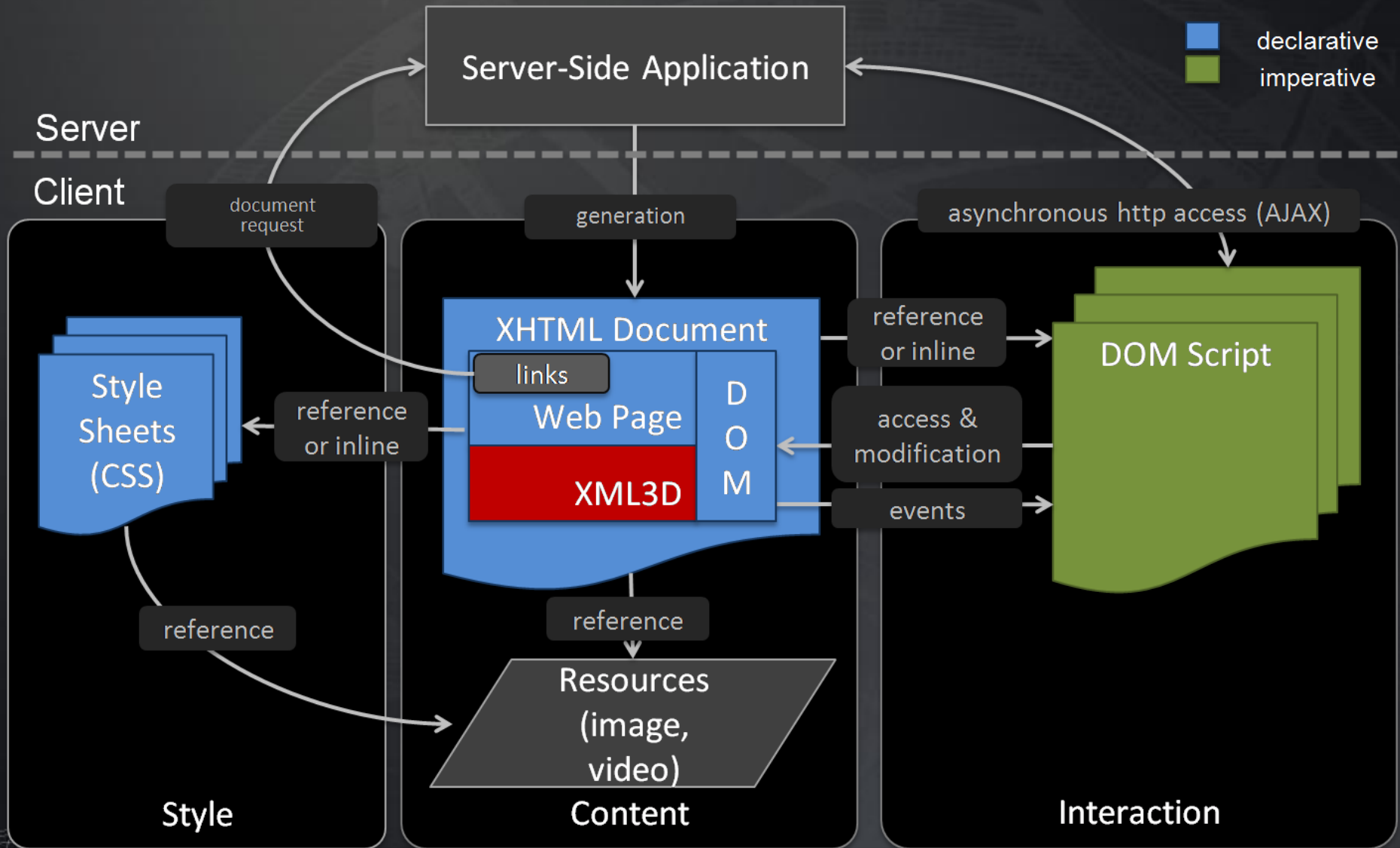
Structure of Content: 2D Web



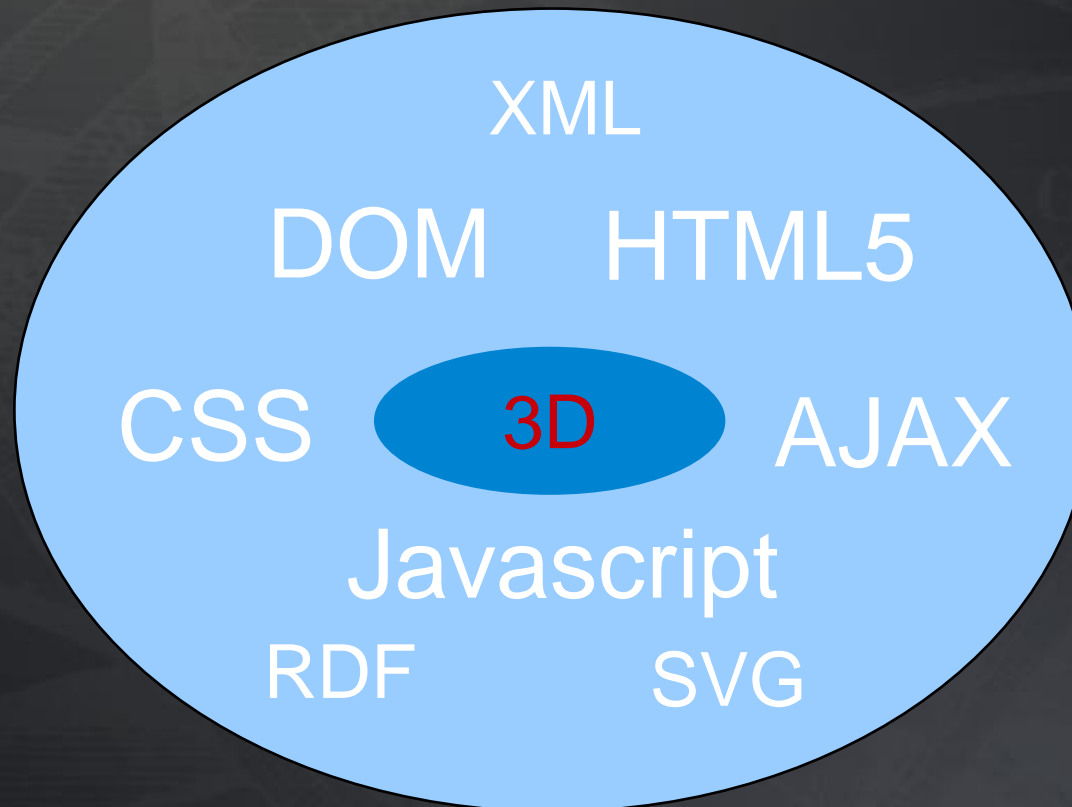
Structure of Content: 2D versus 3D

	2D	3D	Representation
Content	text, structure, image, video	geometry, structure, shader, texture	HTML & resources
Style	layout, color, font	transformations, shader assignment	CSS
Interaction	selection, animation	selection, animation	DOM scripting

Structure of Content: 2D Web



Integrating 3D into the Web



W3C

Millions of Web programmers



AGENTS and
SIMULATED REALITY

DFK Deutsches
Forschungszentrum
für Künstliche
Intelligenz GmbH

What's Special About 3D?

- **Visual formatting model not applicable in 3D**
 - No Box model for layout in 3D
 - 3D space typically unlimited
 - ▶ **Not needed, use absolute 3D transformations**
- **Re-use of objects (instancing)**
 - Possible in SVG, not in HTML
 - Important for geometry, shaders, transformations, ...
 - Avoid conflicts with CSS inheritance
 - ▶ **Use relative URLs (fragments) and only CSS**

What's Special About 3D? (Cont.)

- **Programmability (shaders)**
 - HTML, SVG, and CSS have “*fixed function shading*”
 - 3D heavily relies on *programmable shaders*
 - Would not be competitive without programmability
 - Shader types: material, light, geometry, ...
 - Need portable solution
 - Many incompatible languages: glsl, HLSL, Renderman, ...
 - Needs generic data definitions
 - Almost arbitrary input parameters, but fixed types
 - ▶ **Add special element where needed**
 - ▶ **Assign via CSS as in HTML**



What's Special About 3D? (Cont.)

- **Large data sets**
 - Much larger than text: 3D geometry, textures, ...
 - Similar to images/audio in HTML
 - But with rich internal structure → DOM
 - DOM APIs are not designed for this: Access is via text
 - Optimized handling in 3D engine
 - No duplicate storage of data (especially not as text)
 - Compression for transfer and parsing (e.g. EXI, FI)
 - ▶ **Efficiency via optimized management/rendering**
 - ▶ **Data should be stored once on 3D side**
 - ▶ **Access via DOM API extension (typed arrays)**



What's Special About 3D? (Cont.)

- **Dynamic changes to data**
 - Need efficient processing of large data sets
 - Animation, image processing, physics, ...
 - Should be able to exploit data parallel HW
 - Power efficiency of Javascript?
 - ▶ **Declarative and safe exposure of data-parallel HW**
- **Interactivity**
 - More complex 3D interaction metaphors
 - Different input devices (e.g. multitouch, 3D mouse, ...)
 - Continuum from basic to application/data-dependent
 - ▶ **For now: rely on JS libraries**

Summary

- **Ongoing Activities**

- German Spitzencluster Project (IGD & DFKI, w/ SAP, ...)
- DFKI
 - EU Future Internet PPP (with Disney, BlackRock, ...)
 - GIS-Integration on the Web (Caigos)
 - 3D Characters in Web
- IGD
 - Cultural Heritage (IGD)
 - Visualization of Simulation Results (IGD)
- XML3D is focus at Intel Visual Computing Institute:
 - Capturing 3D for Web, Shading, Programming, Gesture, Interaction, ...

Summary

- **Main take-away**
 - 3D will be a hot topic – particularly on the Web
 - W3C should play major role for **declarative 3D**
 - Two fully working prototypes: XML3D and X3DOM
 - DFKI, IVCI, and IGD joining forces
 - ▶ **Feedback from and interaction with W3C**
 - ▶ **Aim: Launch Incubator Group for discussions**

Visit <http://www.xml3d.org>