

Interchange formats

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- Track and object model
- Real-time transfer
- Different interchange formats
- Comparison

Introduction

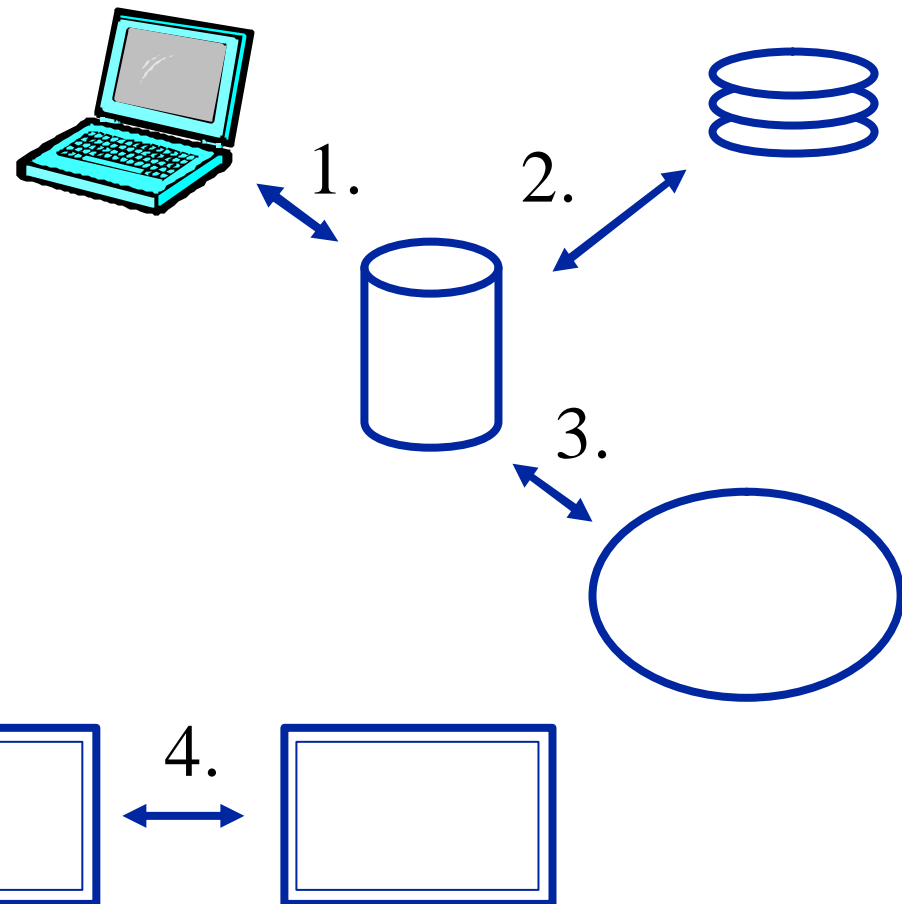
- In transfer of multimedia applications, platform and software independent interchange formats are needed
- Interchange formats can be based on
 - + tracks
 - + objects
- Most of the interchange formats are file formats, but some support also real-time transfer

General

- Interchange format defines:
 - + time, place, structure, and function (scripts)
- Without a common interchange format, content developed with one application cannot be read and used on another application
- Interchange formats are either public or proprietary
- Conversion tools are not a satisfactory solution

Application areas

1. Storage format
2. Transfer format
3. Real-time transfer format
4. Information interchange between applications



Purposes

- In multimedia systems, a common interchange format can be used in many places:
 - + applications: interchange format acts as API
 - + media server: interchange format defines timing
 - + databases: information is stored and read according to the definitions of the interchange format
 - + network: control according to the parameters of the interchange format

Different formats

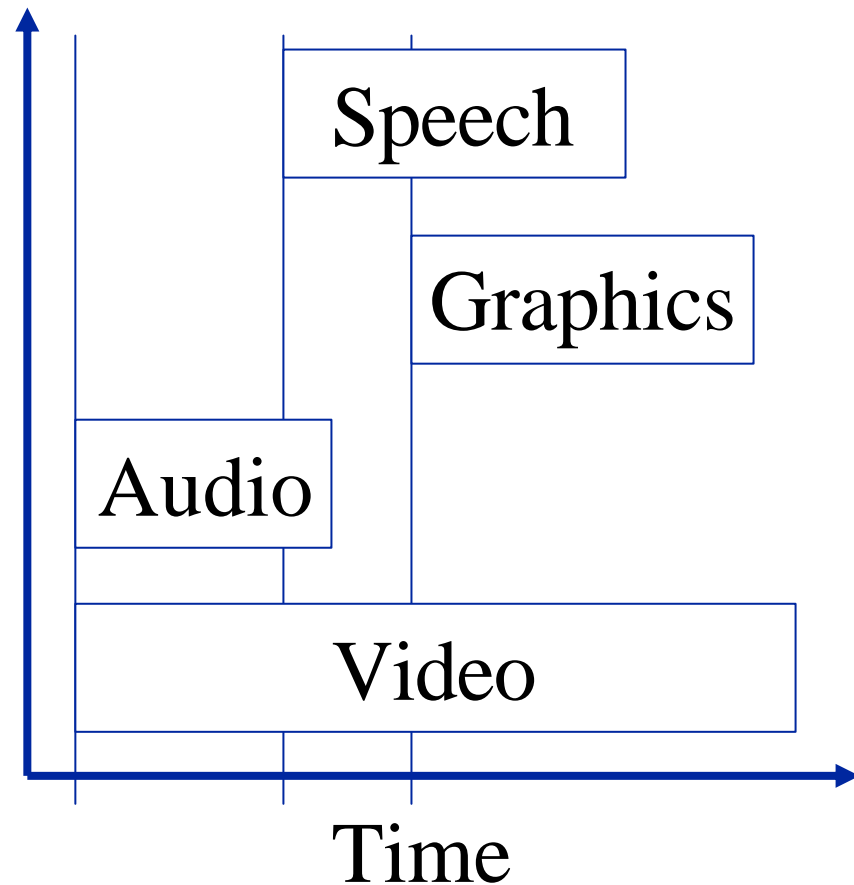
Category	Example
Common format	ASN.1
Multimedia document	HyTime DTD
Presentation format	QuickTime, MHEG
One media	MPEG

Requirements

- **Data model:**
 - + time, synchronization, different formats, pointers, links, interactivity
- **Scripts:**
 - + programming language or graphical programming
- **Capacity:**
 - + definitions should not take much space
- **Retrieval time:**
 - + decompression has to be fast, progressive resolution, etc.
- **Interdependency:**
 - + hardware and platform neutral
- **Scalability:**
 - + new formats, attributes, etc.

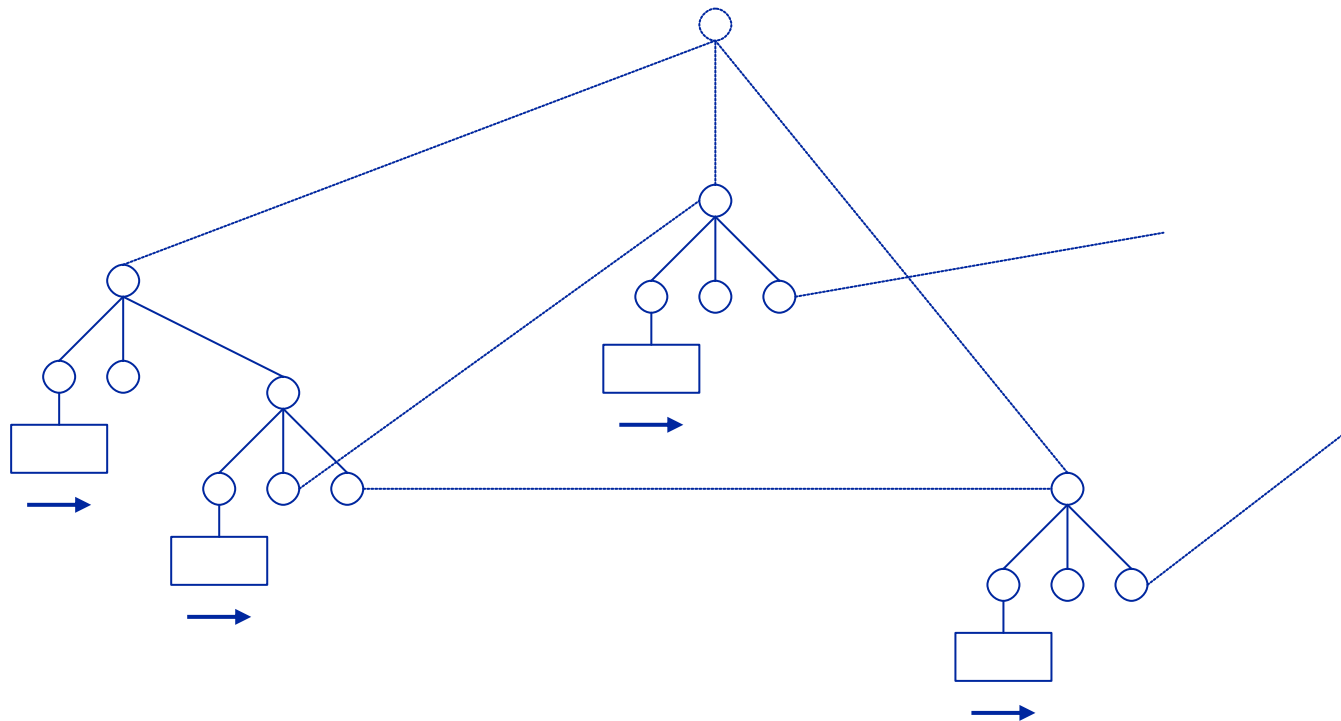
Track model

- Multimedia document is a list, which tells in which order the components are displayed
- In track model, retrieval order is defined by time



Object model

- In object model, the retrieval order is defined according to the data structure



Track model implementation

- In track model, players are synchronized

// Open

Initialize clock

Initialize movie, track, and media indices

Initialize handlers

// Players

Repeat

 Get next segment of media

 Call handlers

 Advance clock

Object mode implementation

- Object model allows better the implementation of interactivity

```
// Open
Get table of contents, object tables
Initialize presentation processes
// Present
Repeat
  Repeat
    Get set of objects to be presented
    Invoke players for each object
  Until media event or input condition
  Pass input condition to application
  or script to interpret
  Identify next set of object to present
Until exit condition
```

Real-time transfer

- Media objects have to be transferred and rendered according to the definitions of interchange format
- Object retrieval, display, and interactivity has to happen within certain time limits
- In troubles, image frequency and resolution, etc can be dropped
- The interchange format can also be optimized

Methods

- Location of objects
 - + objects to be retrieved at same time should be close
- Partial retrieval
 - + big objects are retrieved in parts, because they cannot be shown at once
- Order of objects
 - + retrieval should maintain presentation order
- Indexing of objects
 - + create fast object retrieval table

Methods (cont.)

- Interlacing of objects
 - + big objects retrieval is multiplexed
- Descriptions and content are retrieved separately
 - + descriptions are fetched first
- Progressive retrieval
 - + images are first retrieved with low resolution
- Resource recommendations
 - + resource requirements are announced before hand

Different interchange formats

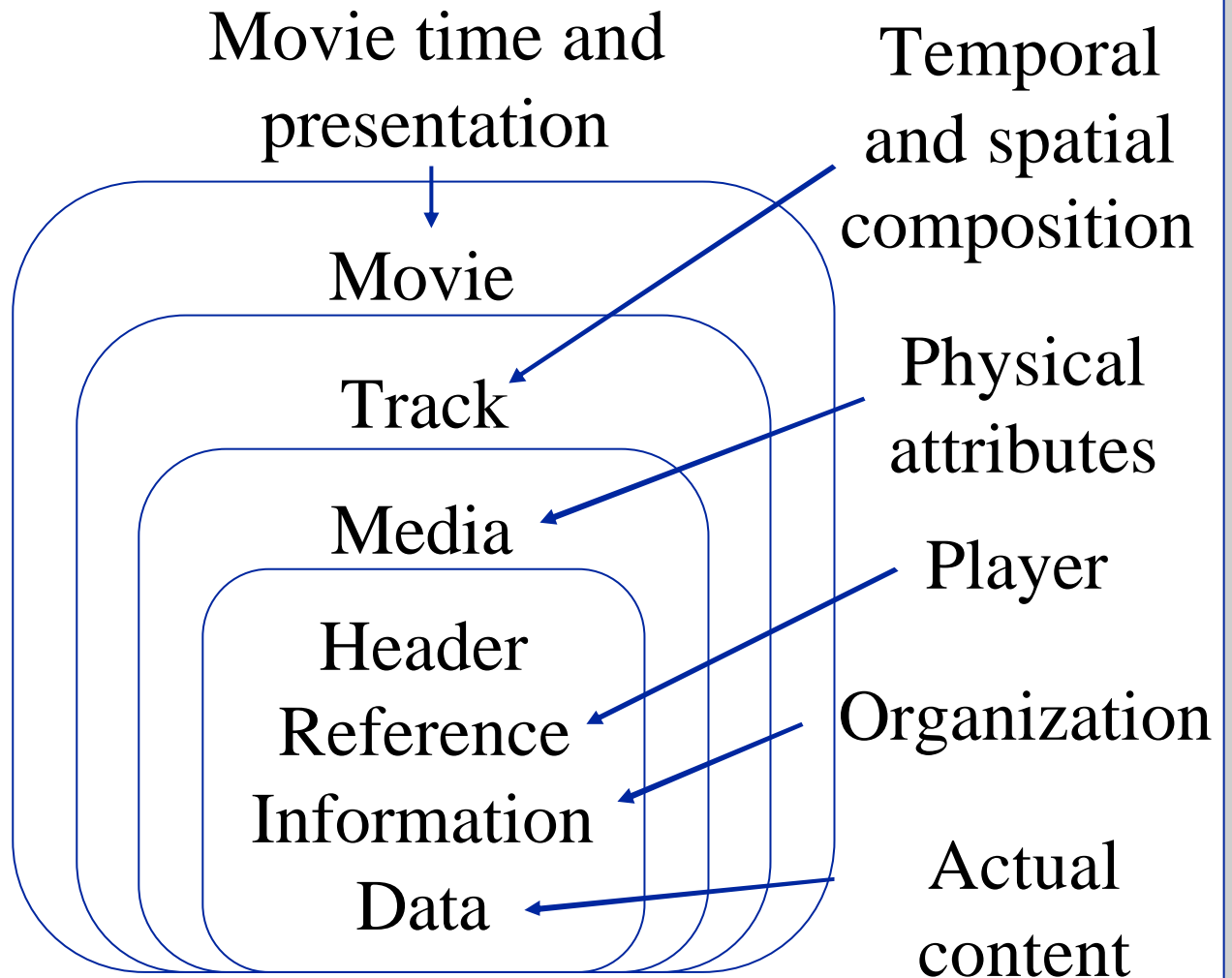
- QuickTime
- MHEG
- HTML
- XML
- Macromedia

QuickTime

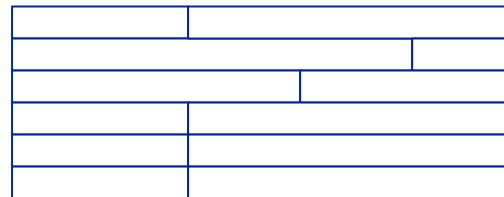
- QuickTime allows the creation, integration, and presentation of different media types
- QuickTime is composed of three layers:
 - + QuickTime Movie File
 - + QuickTime Media Abstraction Layer
 - + QuickTime Media Services
- QuickTime allows the structural, spatial, and temporal definition of multimedia application
- It cannot be used to define interactivity

QuickTime Media Format

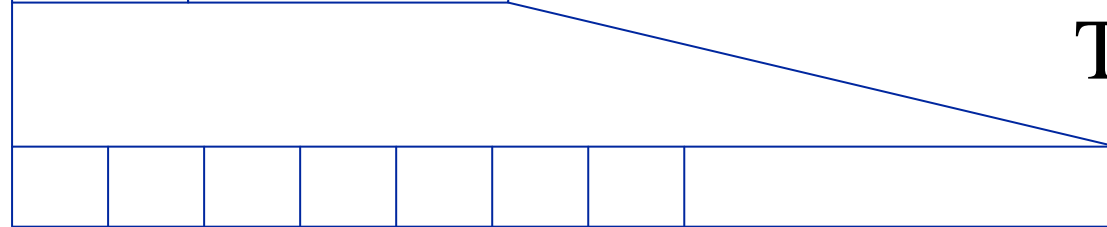
- Apple multimedia file format
- Based on track model
- One movie can contain several tracks



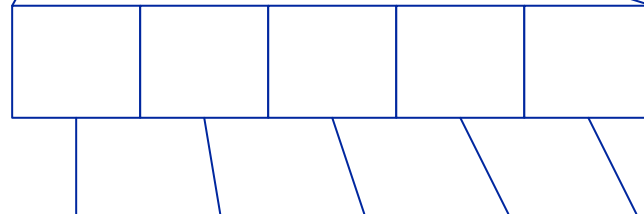
QuickTime movies



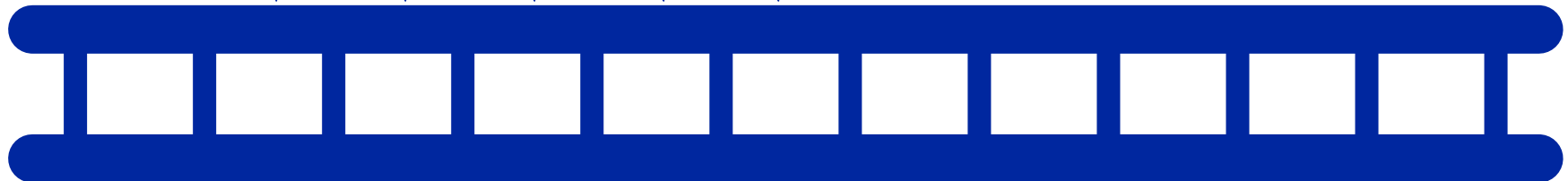
Movie composed of several tracks



Track composed of media elements



Media elements linked to physical media



MHEG

- ISO working group
- Object based multimedia and hypermedia interchange format
- Supports interactivity and real-time transfer
- Defines final presentation format

Properties

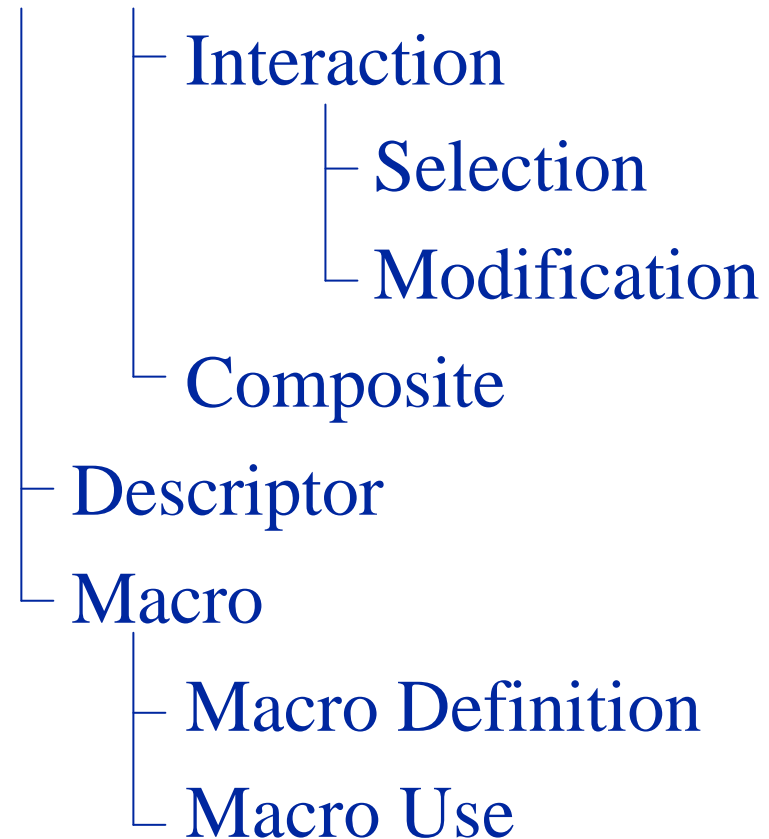
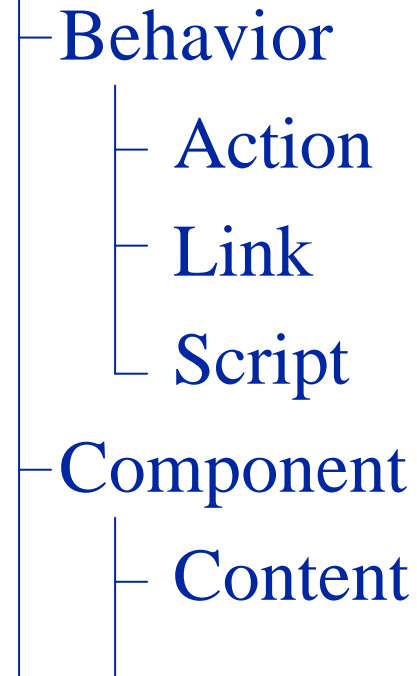
- Defines a set of platform independent components for interactive applications
- Two ways to implement interactivity:
 - + components are linked to events
 - + scripting language is used
- Events are caused by timers or user's actions

Properties (cont.)

- Defines both temporal and spatial location
- Macros allow the definition of complex objects based on models
- Contains also support for real-time transfer

MHEG class hierarchy

MH-object



MHEG Demo

- Digital TeleText
- Based on MHEG interchange format
- Composed of media elements and MHEG files
- MHEG is used in digital television in UK

MHEG tools

- Several half ready tools
- Tools can be divided into three groups:
 - + MHEG editors
 - + Template editors
 - + Conversion tools
- So far, MHEG format has been used little, and thus there is no market for tools

HTML

- HTML documents are composed of text and markup commands
- Current HTML 4.01 does not support element placement, synchronization, nor interactivity
- stylesheets (Cascading Style Sheets) allow the placement of elements (CSS2)

HTML (cont.)

- Interactivity can be defined with ECMAScript
 - + standard is based on JavaScript and JScript
- ECMAScript programs can modify document via the Document Object Model (DOM) API
- The temporal synchronization of documents is still coming
 - + Synchronized Multimedia Integration Language (SMIL)

Stylesheets

- Stylesheets allow the definition of placement, style, and outlook of the elements
- WWW-page can be composed of several layers
- The content and outlook of presentation is defined separately
- Same content can be used in different terminals
- At the moment CSS1 & CSS2 are in use and CSS3 is coming

ECMAScript-262

- Based on JavaScript and JScript
- Simple interpreted language (e.g., Basic)
- Developers can write scripts, which can modify the outlook of the www pages
- Allows the development of different kinds of applications

Document Object Model (DOM)

- An internal tree like data structure of browser
- Object oriented API
 - + inside the browser the document can processed as object data structure
- Allows the manipulation of all www elements
- Same script works in all browsers
- Works both with HTML and XML pages

SMIL

- Presentation can be composed of several files of streams
- SMIL defines the synchronization of the elements
- Different version of the elements (e.g., video) can be used in different situation (e.g., mobile access)
- A separate file in XML format

HTML tools

- Several tools support HTML 4.01
- WYSIWYG editors are very popular
- Only few tools (and browsers) support stylesheets
 - + SoftQuad HotMetaLPro 6.0
 - + Macromedia Dreamweaver
- ECMAScript requires programming skills
 - + Netobjects ScriptBuilder
- SMiL and HTML+TIME support limited
 - + RealNetworks RealPlayer 6.0

XML

- XML is meta language, which can be used to define different kinds of documents (e.g., XHTML)
- Stylesheets are defined with XSL
- Another alternative is to use CSS stylesheets
- Interactivity is defined with ECMAScript and DOM model
- Temporal synchronization requires the use of SMIL

Mixed Namespaces

- Mixed namespaces allows the use of several XML languages in the same document
- A prefix in a tag identifies the language, to which the tag belongs
 - + E.g., `<smil:layout>`

SMIL+XForms

file:/home/pcesar/src/xsmiles/demo/smil/car/demotv.smil

George's car garage

Buggy	Normal	Normal
Explorer	Convertible	Spike
Formula 3000		Monster



\$ 1000

Order

XML tools

- XML is still not mature in browsers
 - + most of the browsers support only part of the specifications
 - + www.x-smiles.org
- Several software component are available
- Tools are rudimentary

Macromedia

- Macromedia is the biggest producer of multimedia development tools
- Macromedia Director is the most common development tools
- Macromedia had two interchange format for www distribution
 - + Macromedia Shockwave
 - + Macromedia Flash
- Either one of the formats is perfect

Shockwave

- Allows the display of multimedia applications made with Macromedia Director in www browser
- A separate application installed as plug-in of browser
- Files are big and difficult to use in current Internet

Flash

- Original name is FutureSplash
 - + Macromedia bought the company in 1997
- Based on vector graphics
 - + no images - just drawing commands
- Requires a separate plug-in program in www browser
- A separate tool to produce applications
 - + a reduced version of Macromedia Director

Flash-demo

- Grokbot www.grokbot.com
- Dancing Bush www.miniclip.com
- Humor Bin www.cards-n-toons.com

Comparison

	Quick	MHEG	HTML	XML	Shock	Flash
Open	Weak	Yes	Yes	Yes	No	No
Track/object	Track	Object	(DOM)	(DOM)	Track	Track
Interactivity	No	Yes	Weak	Weak	Yes	Yes
Hyperlinks	No	-	Yes	Yes	-	-
Scripts	No	Yes	(ECMA)	(ECMA)	Yes	No
Synch.	Yes	Yes	(SMIL)	(SMIL)	Yes	Yes