DiBEG
Digital Broadcasting Experts Group

Datacasting

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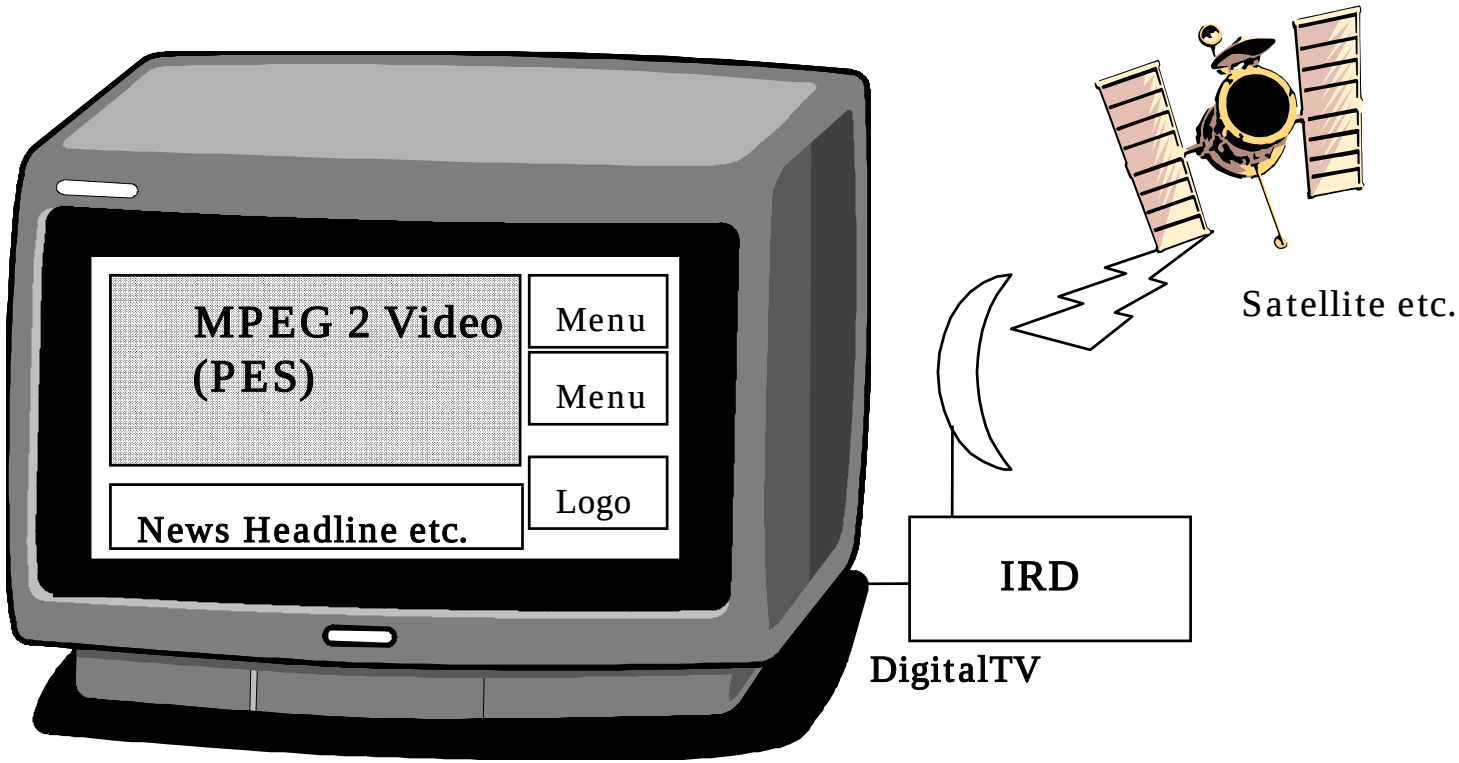
What is Datacasting?



Typical service image of data broadcasting (datacasting)

Example for Datacasting(1)

Top menu

Example for Datacasting(2)

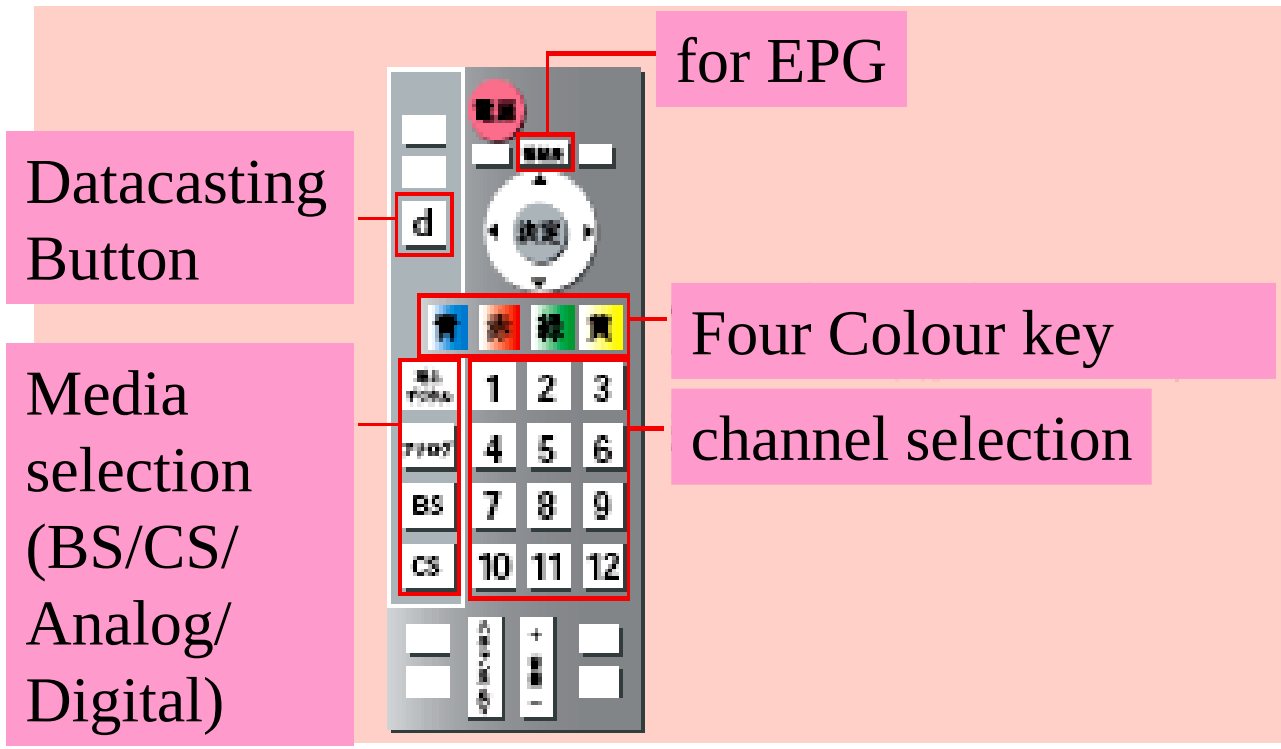
Weather news

Example for Datacasting(2)

Program related data

Remote Controller for Datacasting

- Colour key and Arrow Key (four directional)
- Datacasting Trigger Button
- Back key (for interactive application)



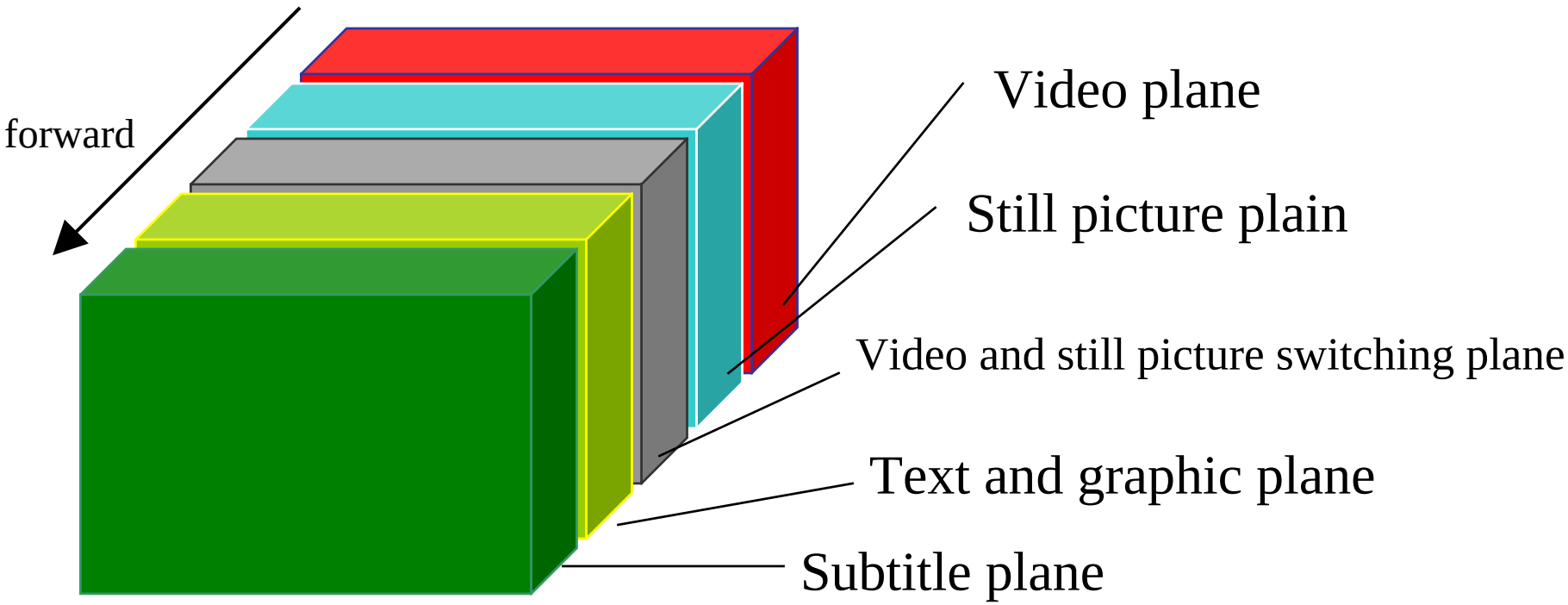
Brief Information of the receiver

- Receiver model
  - Detail of the receiver structure will be available later (Section #7)
  - Here are for understanding datacasting format.
    - Existence of text graphic plane, still picture plain, video plane, etc..
    - Alpha blending between each plane

Plain concept of the receiver

See STD B24 Vol.1 Chapter 7

- Plain model



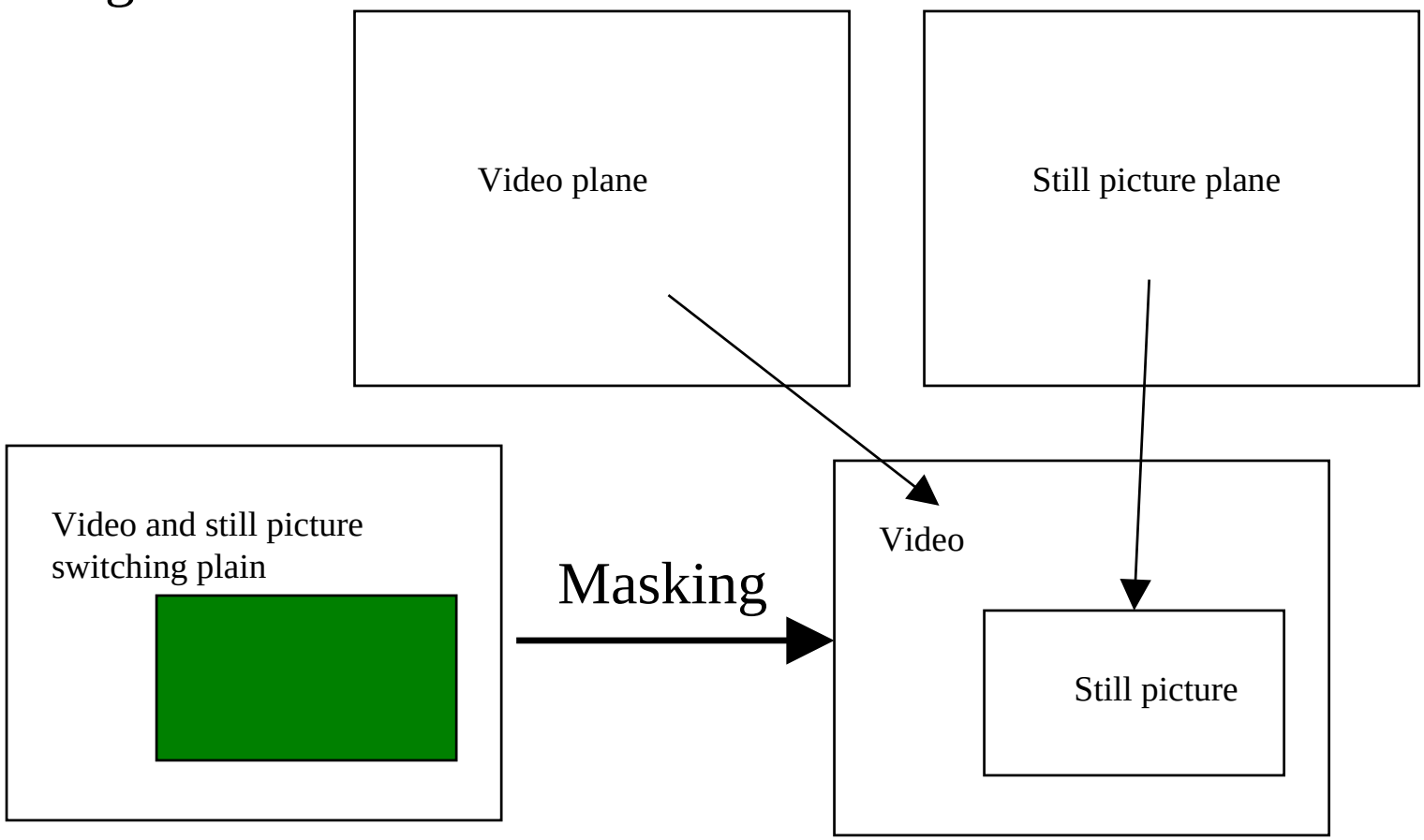
Plain concept of the receiver (cont.)

See STD B24 Vol.1 Chapter 7

- Plain format
  - Video ･･･1920x1080x16 YCbCr(422) 8bit
  - Still picture ･･･ Same as video plane
  - Video and still picture switching ･･･1920x1080x1 1bit
  - Text and graphic ･･･1920x1080x24 YCbCr(444) 256 steps alpha blending
  - Subtitle･･･1920x1080x8 8bit colour map address and 256 steps alpha blending

Plain concept of the receiver (cont.)

Switching control



Standardization of Datacasting

- ARIB standardization
  - ARIB Digital Satellite broadcasting development council (established September 1996) found XML working group in February 1999.
  - the XML WG consist of Basic XML Task Group, Advanced XML TG and Service TG.
  - Each TG makes standard and then WG compile into one standard, known as ARIB STD-B24.

Standardizing organization

- ARIB Standardizing activity
  - The Purpose of Basic XML-TG
    - First target is Digital Satellite broadcasting service in 2000.
      - Formulate BML tag set specification
      - Formulate Script language specification
      - Formulate transmitting format for datacasting specification
    - Be designed to datacasting format for across all media
      - Bring CS110, Terrestrial, Satellite Audio channel, Terrestrial audio channel into view

ARIB Standards

- STD-B10
  - Service information and descriptor specification
- STD-B20
  - Transmission System for Digital Satellite Broadcasting
- STD-B24
  - Datacasting specification (Reference Model, Mono-media coding, Captioning, Multi-media coding and transmission specification)
- STD-B25
  - Conditional Access System Specifications
- TR-B13/14/15/26
  - Operational Guidelines

ARIB Standards (cont.)

- STD-B1
  - Desirable Receiver Specification (CS)
- STD-B29
  - Transmission of Terrestrial digital audio broadcasting
- STD-B30
  - Receiver specification of Terrestrial digital audio broadcasting
- STD-B32
  - Audio and video coding specification extension from B20 (especially MPEG2-AAC)

ARIB STD-B24

- B24 consist of three volumes (four books)
  - Volume 1: Mono media
  - Volume 2 (book1/book2): BML
  - Volume 3: Transmission
- Volume 2 consist of six parts
  - Main context (Standard)
  - Appendix 1 (Supplement of standard)
  - Appendix 2 (Basic profile)
  - Appendix 3 (Advanced profile)
  - Appendix 4 (Profile for Mobile phone)
  - Appendix 5 (Profile for Vehicle)

Definition of Datacasting Service

See STD B24 Vol.1 Infomative explanation 1

- Integrated subtitle, graphics, audio, data with Television screen with user interaction
- Also known as Multimedia services

What is Multimedia service?

See STD B24 Vol.1 Informative explanation 1

- Multimedia services mean the service by use of media, which enables to view integrated multiple presentation media interactively utilizing digitizing features.
  - “Presentation media” is derived from MHEG (ISO/IEC 13522)

Overview of datacasting services

See STD B24 Vol.1 Informative explanation 1

- Example of services
  - EPG：TV Program selection
  - Index: Choice of TV program, contents
  - Subtitle: Synopsis subtitle, multi-language
  - Commentary audio: for vision-impaired
  - Program supplemental information: Additional information of TV Program (ex. brief)
  - Multi-view television (Multi angle)
  - User interaction program: Shopping, Questionnaire

Requirements

1. Harmonization with Internet Web content
   - Interoperability between Internet Web content and BML. It is desirable to convert from Internet Web content to BML or vise versa without any significant change of the content.
2. Extensibility
   - It is desirable to extend BML without drastic change of the fundamental standard in accordance with the progress of the receivers, broadcast media and service in the future.
3. Rich content expression
   - Not only simple image presentation but sophisticated control of the images in the various conditions.
4. Unique presentation
   - Unique presentation exactly as content creators produced independent from different BML browsers to avoid different presentation from what creators designed, which sometimes happened in the Web content.

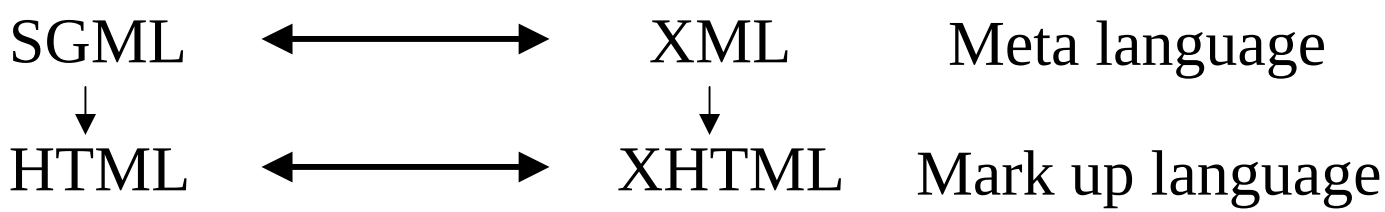
BML

- Multimedia data representation coding scheme for Digital broadcasting
  - Specified in XML
  - Textual notation
  - Extension for broadcasting feature
- XHTML1.0 + ECMAScript + CSS1/2 + DOM1+ Broadcast Extention
  - All component defined by W3C, which is main stream for the internet content specification.
  - difference between broadcast content and internet content
    - bi-directional communication
    - hardware platform (CE vs PC)

XML

- What is XML?
  - The language for making the language using tag (Mark up language)
  - XML itself cannot represent meaning, the language which is using XML is actual language
  - Such a language is known as “meta language”

cf.

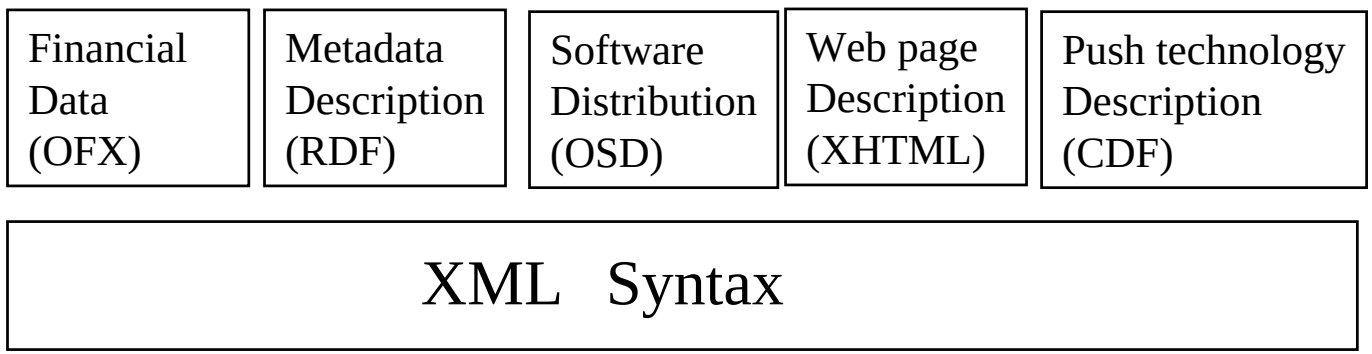


XML

- Feature of XML
  - The language using XML has consistency because they have same syntax and rule
    - XML resource easy to combine each other
      - Combination of multiple XML resource makes various purpose languages
  - Easy validation for language specification because language specification also defined by meta languages such as XML Schema, Relax, DTD.
    - Specification which is described in XML can publish as internet resource.

XML

- Various XML resource
  - all language can combine each other.

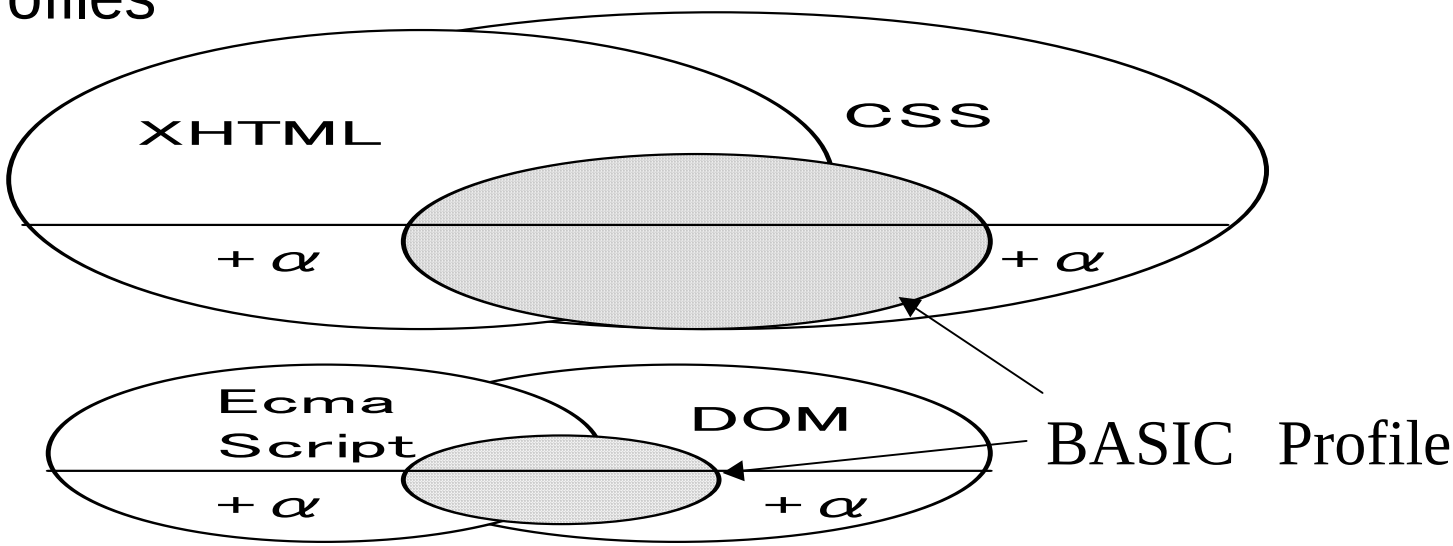


XML adaptation to datacasting

- BML - Data coding scheme for broadcasting
  - Adaptation to broadcasting system
    - As metadata, which is represented context of content or segmentation play back, etc.
    - As content representation which is defined display positioning or content dynamic behavior control
      - Latter is first priority for defining
  - Unique presentation
    - Same appearance for all manufacture products
      - PC CANNOT realize this issue!
  - Functionally extension for broadcasting

Structure of BML

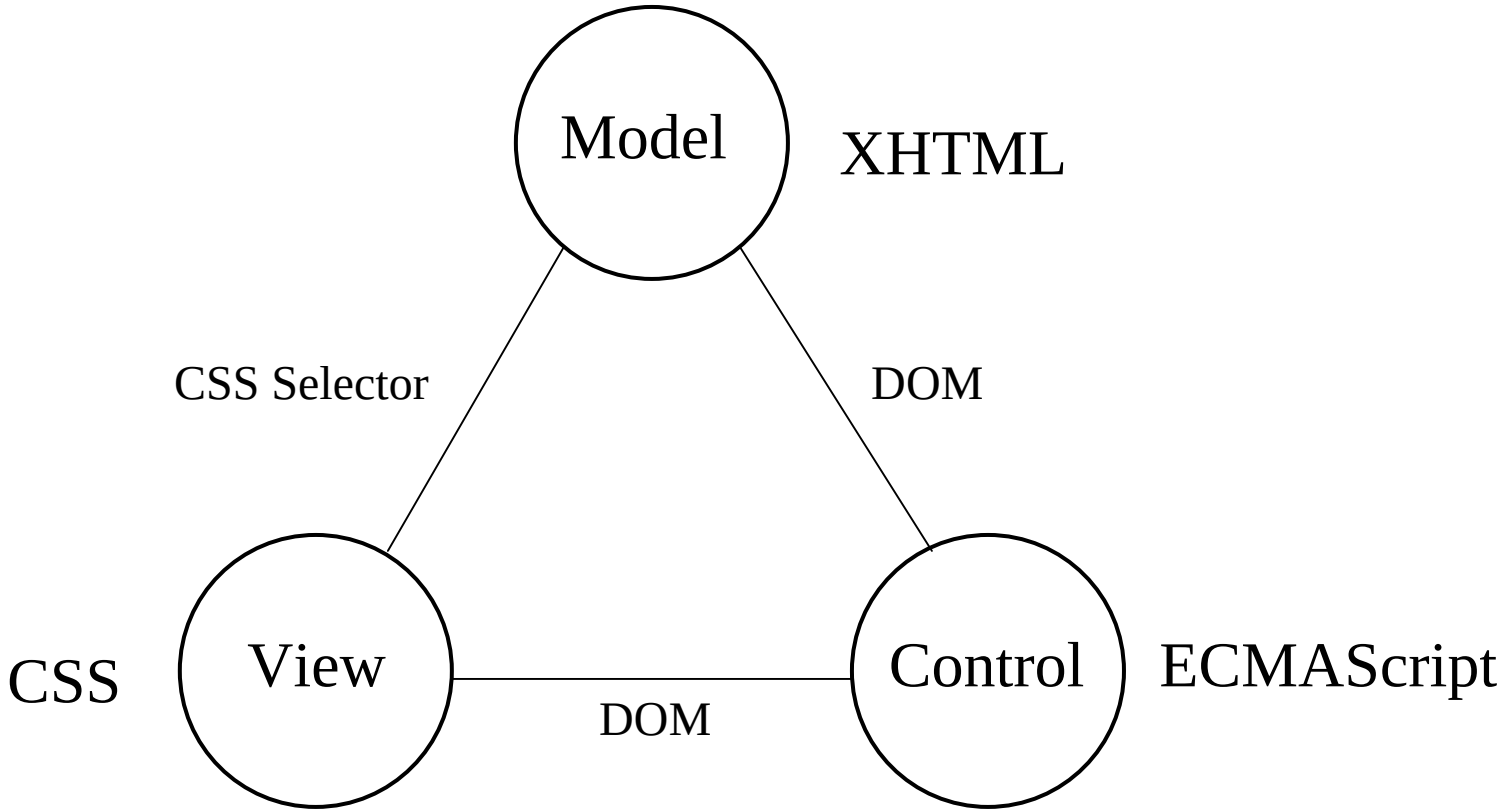
- XHTML1.0 + ECMAScript + CSS1/2 + DOM1+ Broadcast extension
- Basic profile for the service in 2000 (BS Digital) at first, however currently this profile is the basis for all profiles



Structure of Language

- XHTML Part
  - Description of document strucuture, Definition of page element
- CSS Part
  - Provide style to each elements, specify the position
- ECMAScript Part
  - Affect elements each other, rewrite the nodes

MVC Model


Model
XHTML
CSS Selector
DOM
CSS
View
Control
ECMAScript
DOM

XHTML1.0

- Next generation internet content description language is specified by W3C （WorldWideWeb Consortium)
  - http://www.w3.org/TR/xhtml1
  - Rewrite HTML4.0 specification in XML syntax
  - Modularization
    - Available only need functionality
    - Possible to add/delete the module partly

CSS

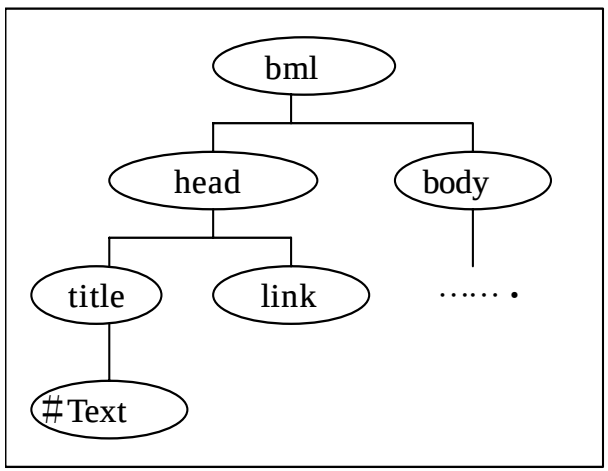
- The language which is for description of style such as layout, defined by W3C
  - http://www.w3.org/TR/REC-CSS2
  - CSS level 1
    - Basic presentation control
    - Simple selector function
  - CSS level 2
    - More complex presentation control
    - Representation of depth
    - Visibility control
    - Aural and speech

ECMAScript

- The standard by ECMA, European industrial standard body
  - There are two de-facto standards for script language at first
    - JavaScript by Netscape
    - Jscript by MSFT
    - Extracting common item from these languages and deleting the window specific function make pure script language. This is the ECMAScript.
  - Presentation process can't describe by ECMAScript only
  - http://www.ecma.ch/ecma1/STAND/ECMA-262.HTM

DOM

- Specification for accessing XML document structure by W3C
  - Known as Document Object Model
  - Specify document structure
  - Specify how to access the document strucuture by script




```
<bml>
<head>
 <title>A study of DOM</title>
 <link   id=”ID1”  rel="stylesheet"
         type="text/css">
</head>
<body>
  ... document body...
</body>
</bml>
```

Difference between BML and HTML

	BML	HTML
Sample	 Suitable operation for TV	
Feature	• **Few hyperlinks per one screen** • **Intuitive providing information by using bitmap and video** • **Scroll is optional** • **Update latest information automatically** • **Synchronize between TV and Radio program**	• **Many hyperlinks in one screen** • **Text centric information providing by small letter presentation** • **Suppose to scroll functionality** • **Need to push “reload” button for retrieving latest information generally**

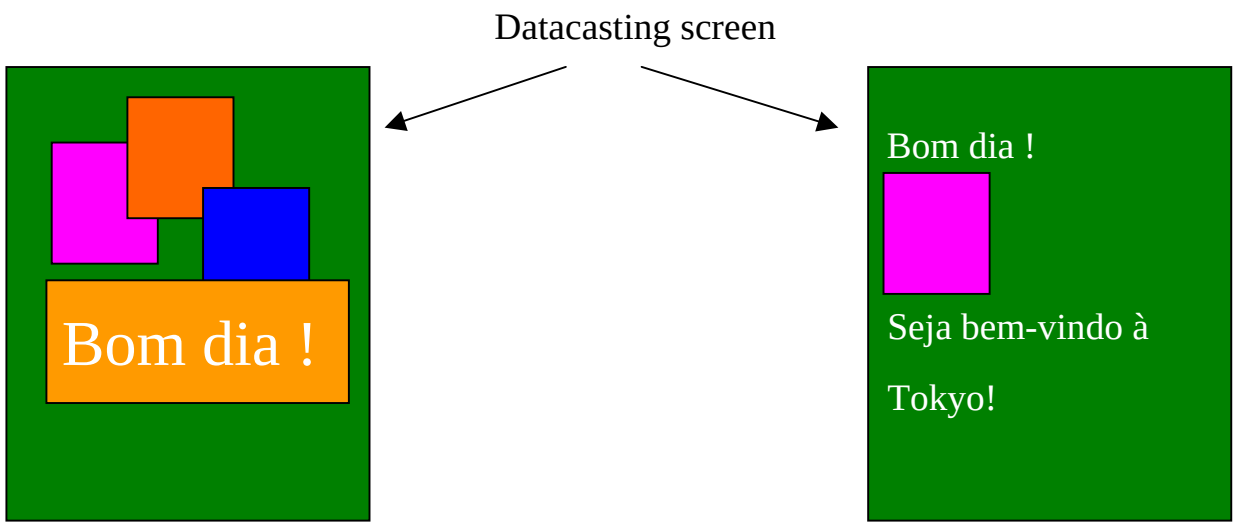
Difference between BML and HTML (cont.)

	BML	HTML
Use case	• **Viewing distance: 1～3m** • **Focus display: Focus of Hotspot** • **Input device: Remote controller with colour key**	• **Viewing distance: 30～50cm** • **Focus display: Free cursor** • **Input device: Wheel mouse + keyboard or Touch panel + keyboard**

Functionality	• Synchronization with TV program (bevent)
	• Accessibility of Set top box (Script API)
	  • NVRAM, Tuner, device ID, etc.
	• Absolute positioning with CSS
	  • Fix display place at reading BML doc
	• Multiple plane model including blending between planes
		• No Sync. Mechanism (cf. SMIL)
		• Accessibility of STB by plug-in module
		• Relative positioning by brawser
		  • Display place may change by context
		  • position can change dynamically
		• Single plane model basis, no transparent colour

Difference between BML and HTML (cont.)

BML	HTML



Only absolute positioning is permitted.

Layout are decided by browser dynamically

BML Extension

- Event synchronization
  <bevent>
    <beitem>
- Color space extension
  - Adapt to receiver model
  - Necessity of alpha blending
- Navigation
  - Introduce remote controller control mechanism
  - harmonize ATSC/DASE PE specification

Event Synchronization

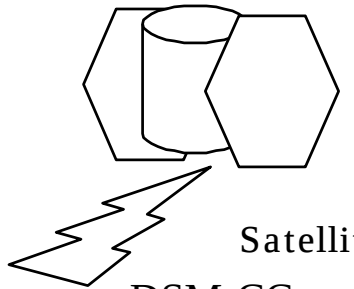
- What is event synchronization?
  - The functionality of synchronous control between main audio and video stream (i.e. TV Program) and BML application
    - Display a recipe along the progress of the cooking program
    - Display a merchandise picture along the progress of the shopping program
    - Display a questionaire 5 minutes before the end of the program
    - etc.
  - Difference from SMIL concept
    - SMIL defined by W3C is similar to this functionality. However...
    - SMIL is quite static representation scheme. It is ready for preprogrammed timing, not real-time. It is inconvenient for live program.

Event Synchronization (cont.)

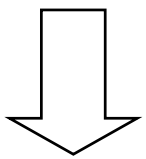
See STD B24 Vol.2 5.3.20.1

- beitem element
  - id attribute
  - type attribute
    EventMessageFired, ModuleUpdated, ModuleLocked, TimerFired, MediaStopped, DataButtonPressed, DataEventChanged, CCStatusChanged, MainAudioStreamChanged, NPTReffered
  - subscribe attribute
  - onoccur attribute

Event Synchronization (cont.)




```
<bevent>
<beitem type="EventMessageFired" onoccur=f();/>
</bevent>
```



Invoke

```
<script>
function f(){
….
}
</script>
```

Script execution

Color space extension

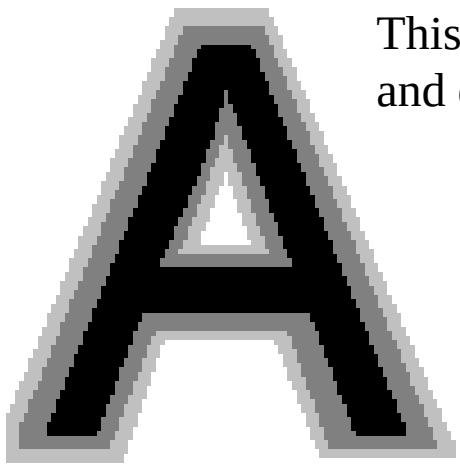
See STD B24 Vol.2 5.4.13

- clut
  - Specify the colour palette (URL)
- color-index
  - Specify the index color with alpha channel
- background-color-index
- grayscale-color-index, etc.

grayscale-color-index

See STD B24 Vol.2 5.4.13.2

- Realize smooth rendering of character by specifying several colours (between foreground and background)



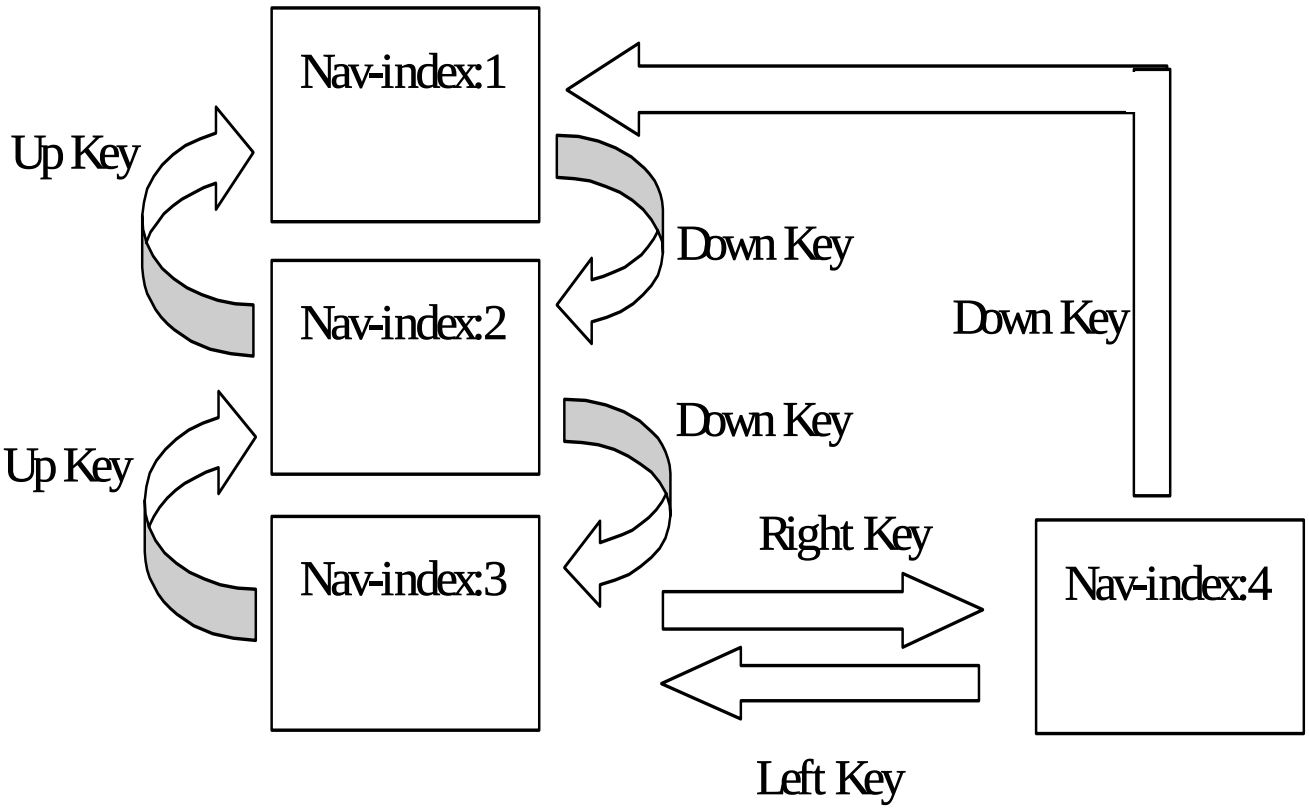
In this case, foreground colour is black and background colour is white. This property set two colours, light gray and dark gray.

Navigation

See STD B24 Vol.2 5.4.13.3

- Specify user navigation control by remote controller
- nav-index
  - indexing focus target
- nav-up, nav-down, nav-left, nav-right
  - specify the target where to move, if the user push the arrow key
- used-key-list
  - Specify the key which datacasting application can use
    - For example, numeric key use as inputting number, not selecting channel number

Navigation (cont.)



Focus navigation

Misc.

- resolution
  - Specify screen size
- scene-aspect-ratio
  - Specify aspect ration of screen

ECMAScript extension

- No extension ECMAScript itself
- Extended Functions (browser pseudo Object) for broadcasting
- these functions can use in script without definition

Extended functions (1)

See STD B24 Vol.2 7.6

- Extended functions for broadcasting
  - EPG functions
  - Event group index functions
  - Series reservation functions
  - Subtitle presentation control functions
  - Non-volatile memory functions
  - Extended APIs for storing

APIs (2)

- Extended functions for broadcasting
  - Interaction Channel functions (Basic procedures, TCP/IP connection)
  - Operational control functions
  - Receiver sound control
  - Timer functions
  - External character functions
  - Functions for controlling external devices
  - Functions for controlling bookmark areas
  - Others (random number, get data and time)
  - Ureg / Greg
  - Functions for Printing

Table operation functions

See STD B24 Vol.2 7.5

- Extended object for broadcasting
  - CSV (Comma Separated Value)
  - Binary Table (Original format)
- For Basic Profile, binary table should be used
  - 4096 columns
  - 1024Byte/records 32 fields
  - 255k bytes maximum

Non-volatile memory functions

See STD B24 Vol.2 7.6

- Not operate by file access, read/write per block (64 bytes * 16 blocks)
- The usage depends on broadcasters
- Assign the area per broadcasters
  - Some broadcaster can’t rewrite another broadcaster’s area
  - Ensure the area which binds by each media (BS, CS, Terrestrial)

External character functions

- Reading per document by extended APIs for broadcasting
  - loadDRCS / unloadDRCS functions
  - DRCS (Dynamically Redefinable Character Set)

BML Basic Profile

See STD B24 Vol.2 A2-4.8

- Restriction the contents description for ensuring uniqueness of content
  - must be specified absolute positioning
  - boxing the elements (only div and p elements containing body element)
  - must be specified nav-index property to all elements which can be focused
  - ECMAScript and CSS are also restricted

BML Basic Profile (1)

- Available elements and declaration in BML document
  - `?xml`
  - `!doctype`
  - `?bml`
- These three declarations are mandatory and must appear this order

BML Basic Profile (2)

- bml
  - bml element consists of one head element and one body element (both mandate and this order must be keep)

BML Basic Profile (3)

- `head`
- In the `head` element, a `meta` element, a `style` element, a `script` element and a `bevent` element appear once at maximum according to this sequence following the mandatory `title` element
- `script` and `style` elements have CDATA section as child elements

BML Basic Profile (4)

- `body`
- `body` element must contain `div` or `p` elements.
- `div` element must contain *boxed* elements.
- `p` element must be PCDATA text or *normal flow* element.
- *boxed* element is with positioning and either one of `div`, `input`, `object` or `p` elements.
- *normal flow* element is without positioning and either one of `a`, `br` or `span` elements.

CSS Restriction

- The style sheet is also restricted.
- It is limited to minimum operation required. The following restrictions are applied to keep the “unique presentation”
  - *Boxed* element must be specified with absolute positioning
  - Not operate the style which will be meaningless due to fixed screen platform
  - Only pixel unit (no use pt, pica, etc.)
  - Not operate complex inherit structure

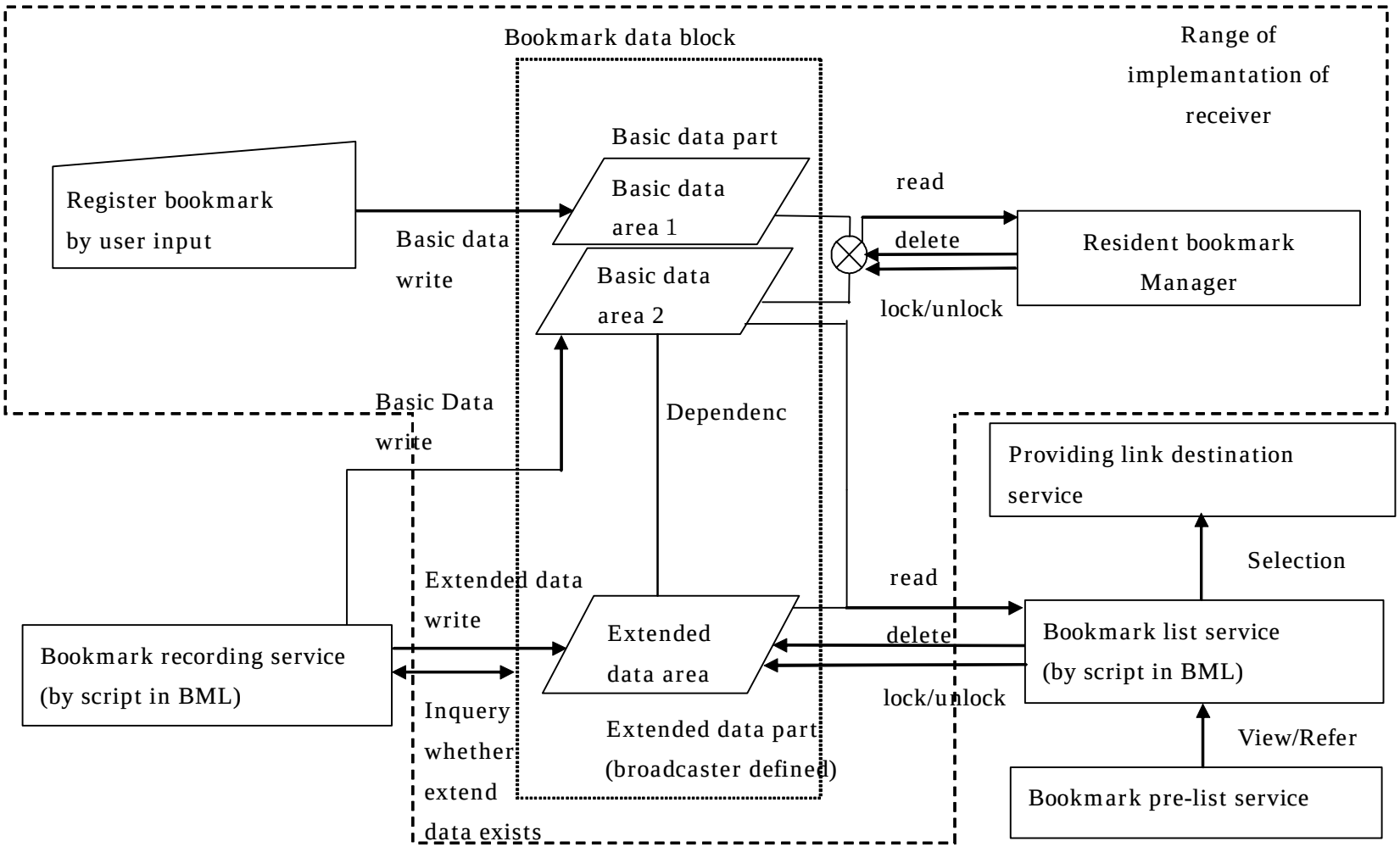
ECMAScript Restriction

- Basic Profile Restriction
  - Number object is support 32 bit, not 64 bit
  - No support for floating number
  - No support for Math built-in class object
  - Character code set is EUC, not Unicode
  - The run-time interruption of a script character string must not be supported. Therefore the eval() function of the Global object is not supported

datacasting for CS110

- CA alternative service
  - Derived to appropriate channel with current CA status
    - promotion channel, etc.
- Recommended contents registration service (bookmark service)

Bookmark concept



Bookmark service

- Registering bookmark by user input
  - Input bookmark with receiver function by user.
  - Basic data corresponding input write into basic data area 1
  - Basic data area 1 can store all kind of user data, however the receiver only can get them (privacy protection issue)

Bookmark service (cont.)

- Bookmark recording service
  - The service which broadcast contents which is recording bookmarks
  - The receiver receives this program and execute BML contents which is included in the program, then the contents can write bookmark into basic data area 2 and broadcaster-specific area
  - And also can inquiry whether extended area is exists

Bookmark service (cont.)

- Resident bookmark manager
  - The receiver has management functionality of bookmark operation.
    - Reading Basic data part
    - Deleting a bookmark in basic data part
    - Setting a flag which indicates permit/accept deleting bookmark
      - Basic data area 2 associated with corresponding extended data
      - If the user deletes a bookmark in the basic data area 2, the receiver must delete the corresponding extended data at same time automatically

Bookmark service (cont.)

- Bookmark list service
  - The broadcaster can distribute the TV program which has list service by BML script
  - The receiver receives the program and execute distributed BML document. The document can delete bookmark in basic data area 2 or broadcaster-defined extended data area and set the flag which permits or accepts deleting bookmark
  - The BML document also can browsing all bookmark lists which is satisfied broadcaster’s demand (especially appearance)

Bookmark service (cont.)

- Pre-list service
  - The service which presents list of bookmark list service channels
  - This service makes the user knows the location of bookmark list service
  - Because the bookmark list service may be operated by several broadcasters, the pre-list service operate as a portal of these list service

Bookmark service (cont.)

- Link destination service
  - The service which broadcasts contents that is related with bookmarked content
  - Select and present by selecting bookmark list service

Storing datacasting

- From B24 ver2.0, added items as follows
  - Basic APIs for storing
    - Save / Move / Delete file function
    - Data retrieving from network (http: https: support)
  - Transmitting MPEG stream with time stump by data carousel
  - Transmitting MPEG4 Video

Datacasting for mobile

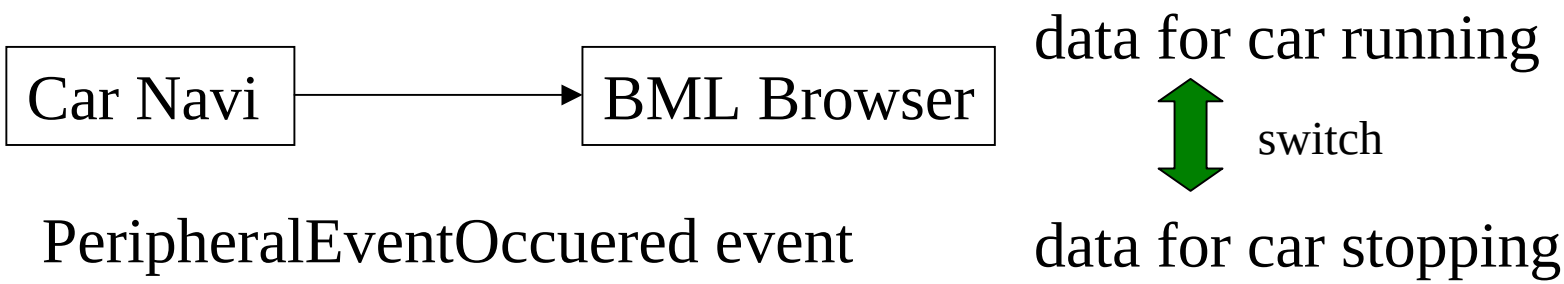
- Corresponding to mobile media
  - Car navigation system
  - Mobile phone
  - PDA
  - Radio

Controlling external devices

- Controlling from external devices
  - using bevent
    - Capable to receive events from external devices by PeripheralEventOccuered
- New ECMAScript API and XML document object are introduced
  - Introducing XML document object can read any XML document and access the document by DOM using ECMAScript and output DOM tree to external file as XML document

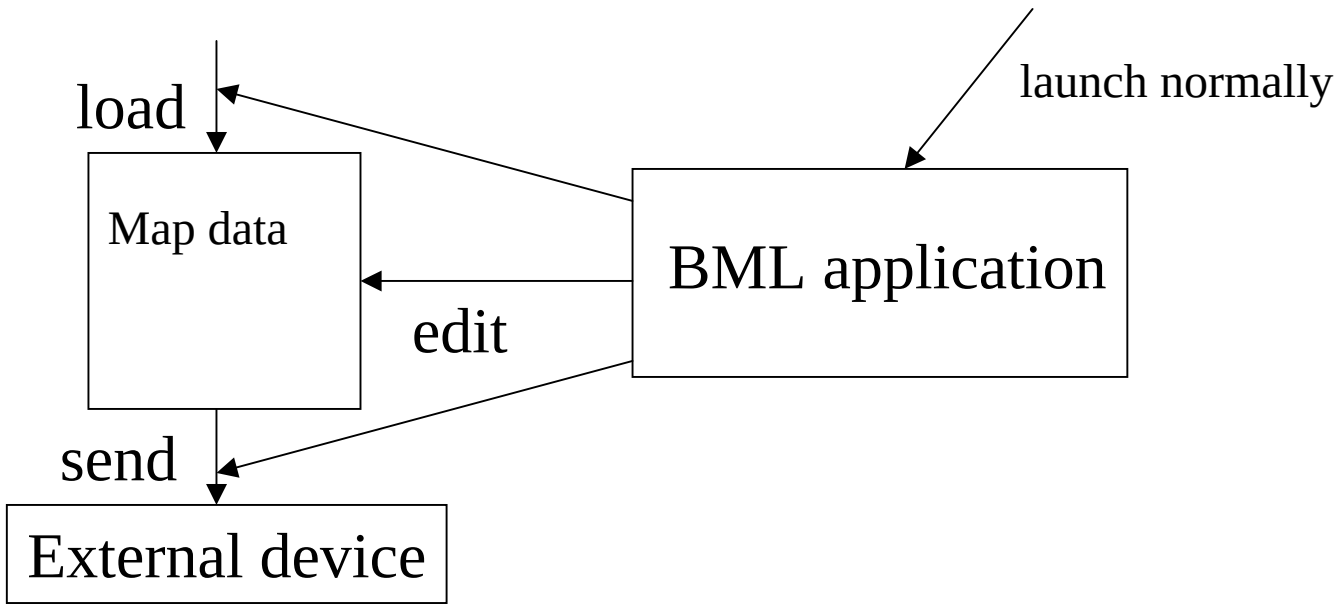
Controlling external devices

- Example for car navigation system
  - Retrieving physical information of the car, for example parking brake status, etc., will change the appearance of contents



XML Document Object

- Handling generic XML document in addition to BML document



Media Crossing

- In the future, mixed version of BML will broadcast at the same time
  - Retrieving browser version API
- Enhanced bi-directional communication
  - IP connection functionality
    - Consideration connectivity to router directly for ADSL
- Consideration of Internet content
  - Introducing Namespace and new tag set, etc.

DiBEG
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Mobile profile

Mobile profile

- On July 22 2004, ARIB Standard Committee approved ARIB TR-B14 version 2.0, however there remains still T.B.D. items
- On September 2004, Version 2.1 approved
- Finally on March 2005 (now!), Version 2.2 approved
  - Unfortunately there is Japanese version only available
  - This profile for mobile phone can handle datacasting contents and communication contents seamlessly

Main concept for mobile profile

- Standard: STD-B24
- Profile of B24 part is Appendix 4
  - Main body + Appendix 1(Mandatory)
    - Appendix 2 (BS/CS110/Terrestrial)
    - Appendix 3 (Advanced profile : unused)
    - Appendix 5 (another mobile profile for Auto)
- Corresponding TR-B14 is known as C-Profile
  - A-Profile : Terrestrial fixed profile (operation guideline)
  - B-Profile : T.B.D.
  - C-Profile : This profile

Mobile Profile (1)

- Used key for datacasting (Virtual key)
  - Specify “enter”, “back” , “bookmark”, “0”-”9”, “*”, “#”
  - “up arrow (↑)”, ”down arrow (↓)” key use for scrolling and moving cursor (do not use in datacasting contents)
  - “left arrow (←)”, “right arrow (→)” do not operate (avoid to overlap the functionality
- Operation of BML elements
  - Link elements can used so that CSS file can be external file
  - Adding capability that specify script file as external file in src attribute of script element
  - root element is <html> not <bml>

Mobile Profile(2)

- Operation of BML elements (cont.)
  - Do not use style element
  - Adding to use pre element which presents string sequence with carriage return
  - Adding to use textarea element which can input multi-line string by user
  - Adding onfocus attribute to object element for focusing its element

Mobile Profile(3)

- Operation of CSS
  - Adding to marquee property which is familiar with mobile phone contents and can scroll text line
  - Screen resolution is fixed in 240x480 (virtual screen)
- Operation of DOM
  - No operate dynamic behaviors of document tree changes
  - Adding to a kind of onoccur event handler of beitem element
    - MediaStopped

Mobile Profile(4)

- Introducing virtual screen
  - C profile introduce 240x480 virtual screen
  - How this virtual screen shall display on device is depends on implementation
  - It suppose that a part of virtual screen may show in the device, such a case, the screen may scroll within the display area

Mobile Profile(5)

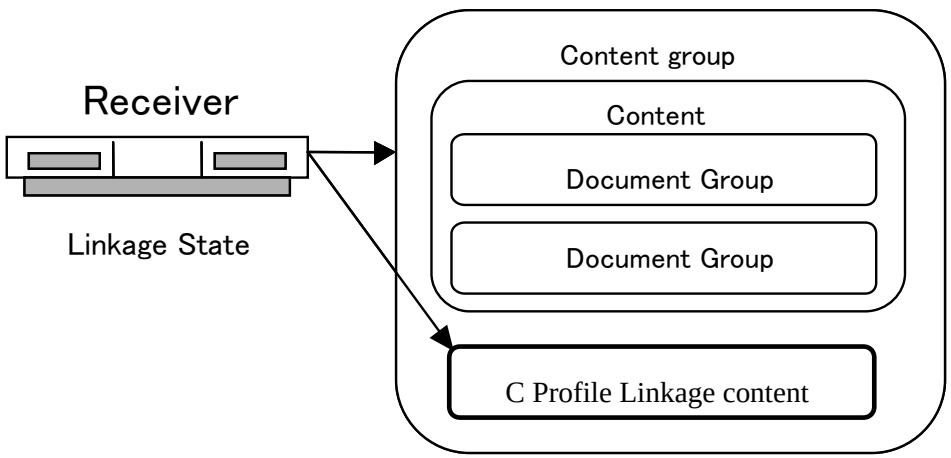
- Extended functions for C profile
  - Mainly it can access to mobile phone functionality
    - calling phone
    - get/set address book
    - get the location information from GPS / station
    - etc.

Mobile Profile(6)

- BML document restriction
  - All BML documents require to add the stylesheet
    - All presentation elements must have the positions
  - No operate vertical writing
  - Presentation mono-media (image/jpeg,png,X-arib-mng) with Object elements
    - Maximum moon-media size = (240x320)
  - Specify the CSS2 property
    - Virtual screen size (240x480) restricts top/left/width/height properties

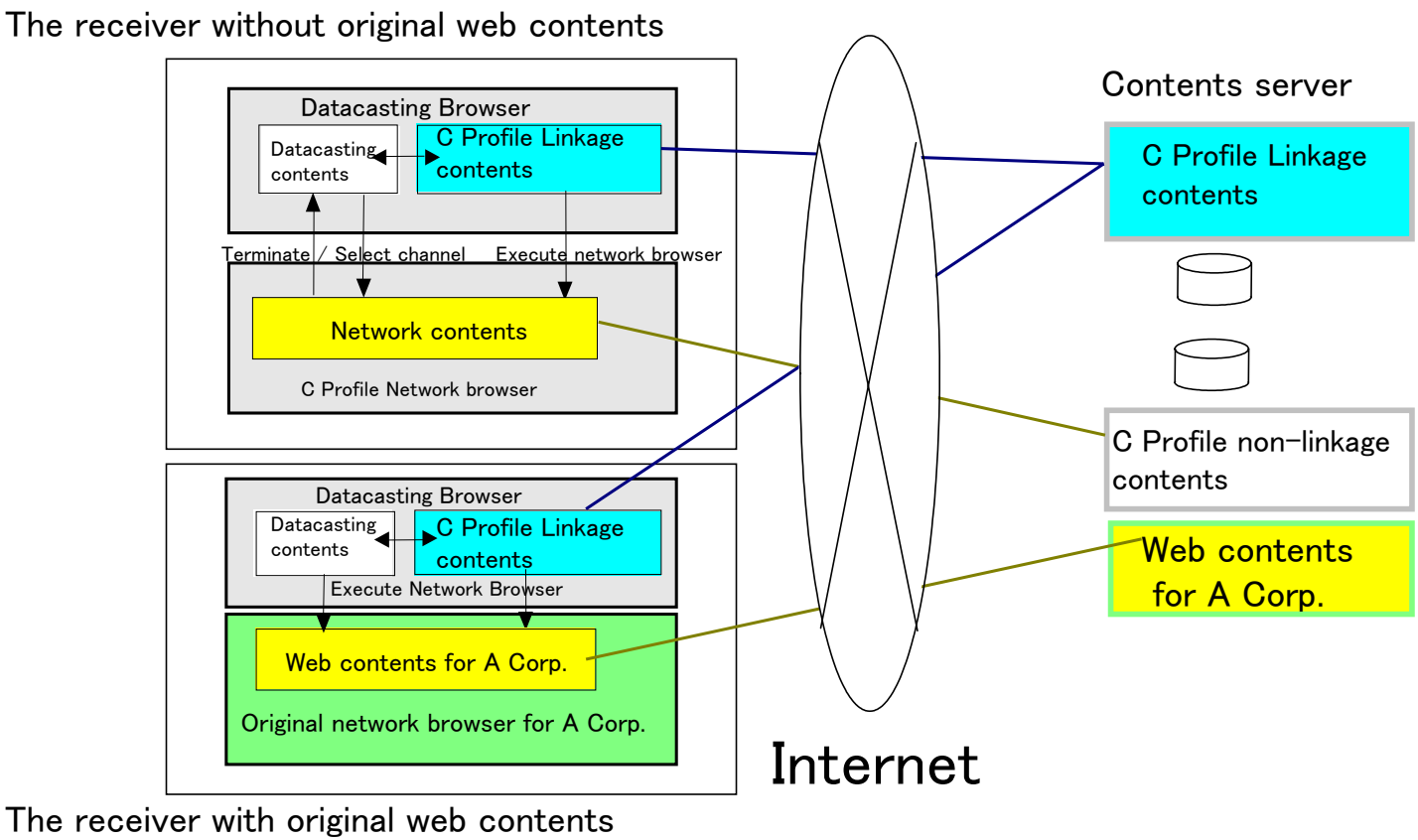
Mobile Profile(7)

- Linkage status
  - Introducing Linkage state which is defined in Terrestrial broadcast
  - Linkage contents are treated as broadcasting content (trusted contents)



Software platform

- Estimated receiver software platform



DiBEG
Digital Broadcasting Experts Group

Execution Engine

PE and AE

- Presentation Engine (PE)
  - Engine for a Declarative content such as HTML, BML, etc.
  - Suitable for stylized application
- Application execution Engine (AE)
  - Engine for a Procedural content such as Java, C, C++
  - Suitable for dynamic behavior application such as games

Advantages and Disadvantages

	Advantages	Disadvantages
PE	●Easy template operation ●Easy authoring without special tool (e.g. notepad)	●Difficult to make real-time application like games
AE	●Easy to make real-time applications ●Software components reuable for other applications	●Difficult to make applications without special tools like a compiler (needs programming skill)

◆Both PE and AE should be supported in Datacasting ideally and appropriately used for each applications

Datacasting in Japan

- B23(AE standard) ver1.1
  - GEM 1.1 fully compliant
  - NO operational guideline is available
- B24 (PE standard:BML) ver.4.0
  - Operational guideline for terrestrial TR-B14 ver2.1
  - Operational guideline for satellite TR-B15 ver3.0
- Currently DTV receiver with BML engine deployed over 4 million.
  - 1.22 (Terrestrial) + 2.45 (BS) + 0.5 (CS)

Features of B23

- GEM fully compliant Japanese standard
  - Additional specifications for Japan
    - Carousel adaptation
      - Object and data are optional
      - AIT on data carousel
    - SI information package (Localized)
    - Screen resolution (Localized)
    - Extended character encoding
      - Composite font
    - Conditional Access

B24 standard

- Matured standard
  - Four year has past since actual use of BML
- Tight coupling between TV Program and BML
- Real-time authoring (football game, live program, etc.)

What remains to be done

- No operational guideline of B23
  - It means there is no demand of broadcaster that uses execution engine currently.
  - ARIB-J (Java) is powerful tool however the broadcaster do not have the idea about appeal point of Java.
    - BML can do anything
    - No thread model for making datacast application
    - Debugging difficulty
    - Cost efficiency

Need to clarify the appeal point of datacasting

To be discussed..

- Evolution toward to new services
  - Investigate combination between mobile phone and television
  - Server type broadcast service
  - etc.
- Developing harmonization among the world
  - DVB
  - ATSC/OCAP
  - ISDB-T

Thank you for listening!