Multimedia情報表現とContent流通System
Multimedia Info-Representation and Content Distribution Systems

第1回 / #1

Introduction

授業内容

授業の到達目標及びTheme

- 「Multimedia情報表現」と「Content流通System」に関する事項を、最新の研究動向を交えて論じる。
- 専門的な知識の獲得と共に、国際標準化動向についても理解を深める。

授業の概要

- マルチメディア情報表現とContent流通Systemに関する種々の基礎的な知識と技術は取得済みであることを前提とする。
- その上で、具体的な応用について、System Architectureの観点、及び、設計思想の観点から、Themeに関する理解を深める。
- また、Global Content流通Platformという観点から、工学的な実現手法及び問題点についても理解を深める。

Class Overview

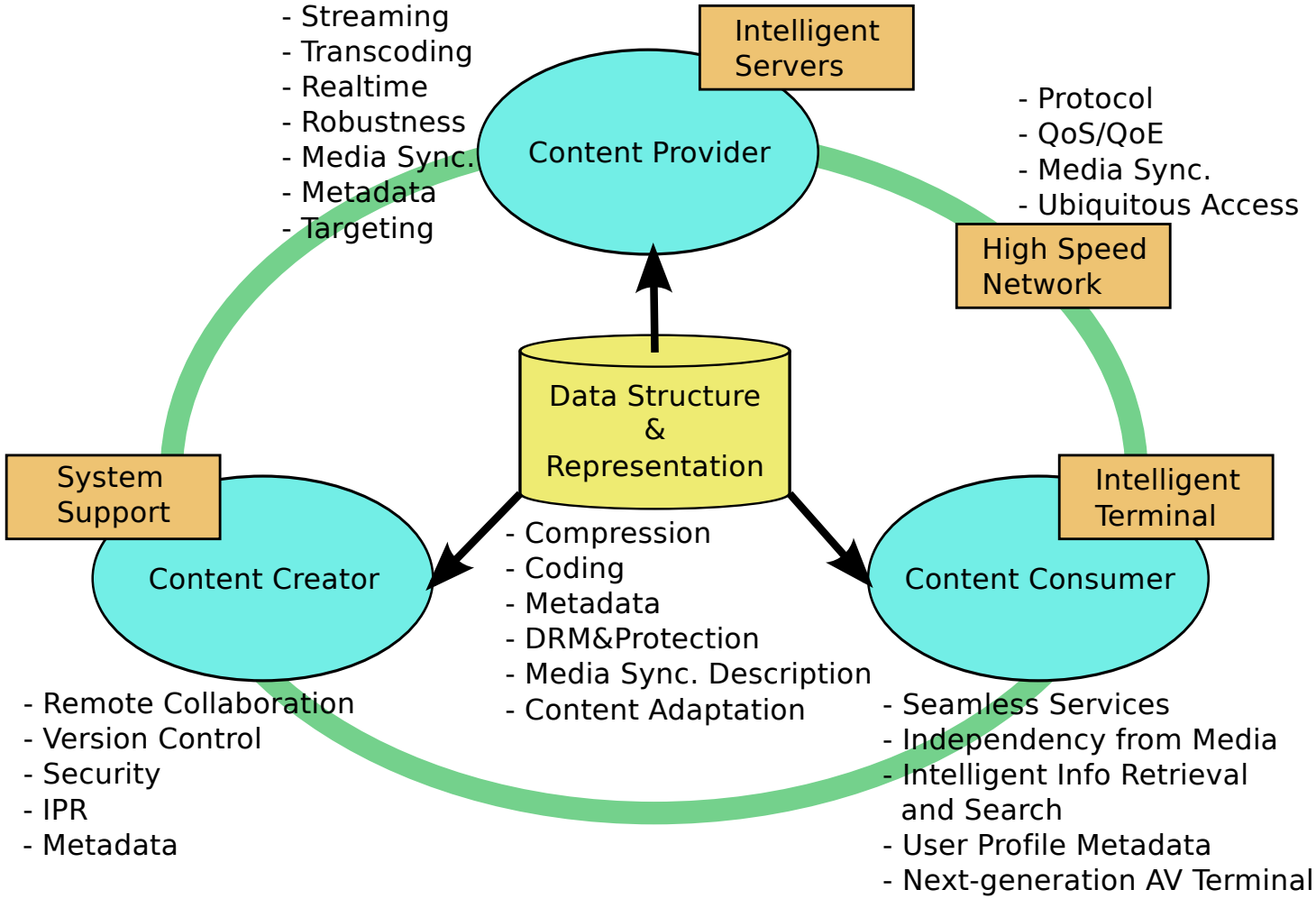
Goal of the Class and Theme

- The goal of the class is to get the advanced knowledge of "Multimedia Info-Representation" and "Content Distribution Systems" including including the cutting-edge of the latest researches about them.
- To understand their research trends and international standardization activities is also focused on.

Outline of the Class

- It is the pre-requirement to have got the basic knowledge of the technologies on multimedia info-representation and content distribution systems.
- Based on that, their system architectures and designs concerning their applications are explored in this class.
- The engineering approaches and their issues including the latest research trends are also covered from the view point of global content distribution platform.

3 Players in Multimedia System



Schedule

1. 4/10 Introduction
2. 4/17 Multimedia情報表現と記述言語 (1) ODA
3. 4/24 Multimedia情報表現と記述言語 (2) SGML, HyTime
4. 5/ 8 Multimedia情報表現と記述言語 (3) XML
5. 5/15 Multimedia情報表現と記述言語 (4) XML Schema
6. 5/22 Multimedia情報表現と記述言語 (5) MHEG-5
7. 5/29 Multimedia記述言語とAPI
8. 6/ 5 情報表現変換とStyle Sheet
9. 6/12 権利記述言語
10. 6/19 意味情報表現と知識情報表現
11. 6/26 Content識別子
12. 7/ 3 Content適応化
13. 7/10 Digital権利管理System
14. 7/17 Digital放送System
15. 7/24 Video-on-Demand SystemとIPTV
16. ---- Report提出

Schedule

1. Apr. 10, Introduction
2. Apr. 17, Multimedia Info-Rep. and Description Language (1) ODA
3. Apr. 24, Multimedia Info-Rep. and Description Language (2) SGML, HyTime
4. May 8, Multimedia Info-Rep. and Description Language (3) XML
5. May 15, Multimedia Info-Rep. and Description Language (4) XML Schema
6. May 22, Multimedia Info-Rep. and Description Language (5) MHEG-5
7. May 29, Multimedia Description Language and API
8. Jun. 5, Information Representation Transform and Style Sheets
9. Jun. 12, Rights Description Languages
10. Jun. 19, Semantics Info-Representation and Knowledge Info-Representation
11. Jun. 26, Content Identifiers
12. Jul. 3 Content Adaptation
13. Jul. 10, Digital Rights Management Systems
14. Jul. 17, Digital Broadcast Systems
15. Jul. 24, Video-on-Demand Systems and IPTV
16. -------, Report Submission

講義方針

- Multimedia情報表現とContent流通Systemに関わる全てを講義することは不可能なので、両者を理解するために基本的に必須の事項に関する講義を行う。
- それ以上の知識の習得は、基本的に個人の学習の範囲と考える。
- 但し、それらを学ぶために必要な情報へのPointerは提供する。
- 本講義では、知識の習得はもちろんであるが、その背後に存在するArchitectureの理解を受講生に求める。

Lecture Policy

- It's impossible to talk about all things of the multimedia info-representation and content distribution systems. Therefore, I'm going to concentrate on some important and necessary topics.
- Your self-study beyond the covered topics is strongly encouraged.
- But, of course, I'll give you the necessary pointers or the references for your further study on request.
- It is essentially requested not only to get the knowledge but to understand the architectures of multimedia info-representation and content distribution systems.

試験について

- 試験は行わない。
- 課題を出し、それに対する回答をReportとして提出することとする。

Term-end Exam and Term Paper

- No term-end exam will be conducted at the end of the term.
- But you are requested to submit a term paper on assignments.

成績について

- 出席によって成績は決めないが、2/3の出席は必須。
- 知識の上に立つ、問題解決能力・問題分析能力・応用能力を評価。
- Reportからのみ成績を評価。

Grading

- 2/3 of your attendance will be required to get enough understanding, but the number of attendance to the class is not the part of the grading.
- Your ability to solve and analyze the problems are essentially graded as your achievements.
- The grading is to be done just by your term paper answers.

参考書等

- http://www.w3.org/
- 「XML技術大全」 Charles F. Goldfarb, Paul Prescod 安藤慶一訳 Prentice Hall
- 「SGML入門」, Martin Bryan, 山崎俊一監訳, アスキー出版
- 「プロフェッショナルXML」, 石川 直太監修/鷺谷 好輝訳, インプレス
- 「エキスパートから学ぶXML実践プログラミング」, 風工房訳, インプレス
- 「IPTV時代のディジタル放送教科書」, 亀山渉・花村剛監修, インプレスR&D
- 「デジタル・コンテンツ流通教科書」, 亀山渉監修著, インプレスR&D
- 「オーディオ・ビデオ圧縮入門」, 亀山・金子・渡辺著, インプレスR&D
- 「改定版 H.264 AVC教科書」, 大久保榮監修, インプレスR&D
- 「H.265/HEVC教科書」, 大久保榮監修, インプレスR&D
- その他

References

- http://www.w3.org/
- "The XML Handbook", Charles F. Goldfarb and Paul Prescod, Prentice Hall
- "SGML, an Author's Guide to the Standard Generalized Markup Language", Martin Bryan, Quorum Technical Services
- "Professional XML", Didier Martin et al, Wrox Press
- "Beginning XML", David Hunter et al, Wrox Press
- "Understanding IPTV. (Informa Telecoms and Media)", Gilbert Held, Auerbach Publishers Inc.
- "Digital Video Transcoding for Transmission and Storage", Huifang Sun, T. Chiang, S. Xuemin, CRC Press LLC
- "A Practical Guide to Content Delivery Networks", Gilbert Held, CRC Press
- "Multimedia Database Management Systems: Indexing, access, and MPEG-7", Harald Kosch, CRC Press
- "Multimedia Systems, Standards and Networks", Puri and Chen, Marcel Dekker
- "Design of Digital Video Coding Systems", Chen, Koc and Liu, Marcel Dekker
- "Introduction to MPEG-7: Multimedia content description interface", Manjunath, Salembier and Sikora, John Wiley & Sons

Resume

- 講義日の前日12:00までに、CourseN@viにUploadする。

- To be uploaded to CourseN@vi by 12:00 on the day before the class

Multimedia情報表現とは?

- 情報を伝えるためには、情報の本質的な意味を構造化して伝える必要がある。
  - *構造を持たない情報には意味がない。*
  - *「伝える」とは、伝送や流通を指す。*
  - *つまり、Content流通のためには、Contentを構造化する必要がある。*
- 何を構造化するのか
  - *情報そのものの構造（文書構造，文脈，起承転結等）*
  - *異なる情報間の関係情報*
  - *情報の2次利用・3次利用に必要な情報*
  - *検索のための情報の意味内容*

What is Multimedia Information Representation?

- Essential meaning of info shall be somehow structured in order to pass it to others.
  - *Unstructured info is meaningless or worthless.*
  - *"To pass" means "distribution" and/or "circulation".*
  - *Thus, content shall be structured in order to distribute it.*
- What shall be structured?
  - *Structure of the info itself (document structure, context, context flow...)*
  - *Relation-info between different info*
  - *Info needed for secondary use*
  - *Semantics needed for info retrieval*

Multimedia情報例 (1/2)

Facsimile Message
Number of Sheets (including this header): 1

平成 26 年 1 月 20 日

From:
〒169–0072
東京都新宿区大久保 3–14–9
早稲田大学シルマンホール 06-03 室
早稲田大学
基幹理工学部情報通信学科
亀山 渉
Telephone: 03–5286–2668
Facsimile: 03–5286–2668
Email: wataru@waseda.jp

TO:
○○株式会社
○○技術開発部
第○部署
佐々木 ○○様
TEL: 012–3456–7890
FAX: 012–3456–7891

いつもお世話になっております。
下記の注文を致しますので、宜しくお取り計らい下さい。

- ○○計測装置一式
- △△測定器一式

手配可能になりましたら、納期をお知らせ下さい。

以上

1

FIT2008（第7回情報科学技術フォーラム）

N-020

A Proposal of Contents Distribution Model
and Analysis of Illegal Contents Distribution on the Small-World Network

Pao Sriprasertsuk† Wataru Kameyama††

1. Introduction

In general, there are two kinds of contents flows in an information distribution; one is the primary information distribution, and the other is the secondary information distribution. The primary information distribution is the distribution done by providers or broadcasters to consumers through certain kinds of media such as television, newspaper, etc. The secondary information distribution is the distribution done by users to users. For examples, one student copies rental DVD and gives to his or her friends. Today, the advanced information technologies enable the secondary information distribution to be able to perform by various methods and media.

Nevertheless, the secondary information distribution has been also increasing the power of illegal distribution of contents, and contents industries have been suffering from it, particularly by peer-to-peer file sharing (p2p) networks. The study of [1] has predicted that global peer-to-peer networks will be effectively stopped by legal means.

In addition, there is another way to illegally distribute contents that is the Small-World Network(SWN)[2] or social network. With the advanced information communication technologies and availability of cheap media, storage devices and high bandwidth networks, distributing contents in the SWN has been becoming easier and more powerful than before. Therefore, it is necessary to analyze and control the power of secondary information distribution.

We have investigated how the secondary information distribution affects the information circulation based on the statistical observation[3]. However, the proposed model does not consider the SWN structure but only the statistical aspects of information distribution being consumed. There are researches[4][5][6] using the SIR model[7] to analyze the effectiveness of information distribution in the SWN. We consider the SIR model is not suitable to represent the real world information propagation cycle since it does not fully take into account the nature of human behavior for information distribution.

In this paper, we propose an information distribution model and equations considering the human behavior. Subsequently, the proposed model is simulated and analyzed by applying the SWN and it characteristics to analyze illegal contents distribution.

2. The Proposed Information Distribution Model

2.1 Model Overview

With regard to the human behavior state for information distribution, we consider that there are three states that are "Unknown", "Known" and "Distribute". The proposed model is shown in Figure 1, and the definitions are described as below.

- Unknown State (U)
  Individuals in this state do not know information. They either do not receive information yet or they forget it. In the case of forgetting information, individuals transit from Known State to this state.
- Known State (K)
  In this state, individuals know information but do not have any action to the information distribution.
- Distribute State (D)

† Global Information and Telecommunication Institute, Waseda University
†† Graduate School of Global Information and Telecommunication Studies, Waseda University

Individuals in this state are active to distribute information. The distribution by their own intentions and other individuals requests are considered in the same.

- Probability of Becoming Known State (B_1)
  This parameter shows the probability of individuals in Unknown State to change into Known State. For example, some individuals in Unknown State are informed with the information by individuals in Distribute State.
- Probability of Becoming Distribute State (B_2)
  This parameter shows the probability of individuals in Known State to change into Distribute State. For example, if individuals in Know State start to distribute the information, they move from Known State to Distribue State.
- Probability of Returning to Unknown State (R_1)
  This parameter shows the probability of individuals in Known State to change into Unknown State. For example, they forget the information because they are not interested or the information becomes stale after time passes.
- Probability of Returning to Known State (R_2)
  This parameter shows the probability of individuals in Distribute State to change into Known State. For example, after individuals distributed the information, they may change their mind to stop the action. Thus, their state is changed to Known State.

With regards to Figure 1 and the above definitions, the notations with time series are defined as below.

- N : the number of all individuals in the network
- $\mathcal{U}(t)$: the number of Unknown State individuals at time t
- $\mathcal{K}(t)$: the number of Known State individuals at time t
- $\mathcal{D}(t)$: the number of Distribute State individuals at time t

Figure 1: The Proposed Model

2.2 The Process of Transiting to Known State from Unknown State

Now individuals get information by being in contact with individuals in Distribute Stage. We assume that each individual in Distribue State contacts k neighbors in each period, and the probability of successful distribution of each individual in Distribue State is B_1. Therefore, the probability of successful distribution for individuals in Unknown State depends on numbers of neighbors in Distribue State. This probability is defined as Equation 1, where G_l is successful distribution probability of individual l and n is the number of neighbors of it in Distribue State.

$$G_l = 1-(1-B_1)^n \tag{1}$$

2.3 Dynamism in R_1

We apply the forgetting curve theory of Hermann Ebbinghaus[8] because it has clearly stood the test of time and has been validated in many numbers of dissertations and follow-up studies. As discussed in section 2.2, new individuals might transit from UnKnown and Distribue State to Known State, and individuals might leave Known State any time. We consider that, when those new individuals transit to Known

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（第4分冊）

Examples of Multimedia Info (1/2)

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Telephone: 03–5286–2668
Facsimile: 03–5286–2668
Email: wataru@waseda.jp

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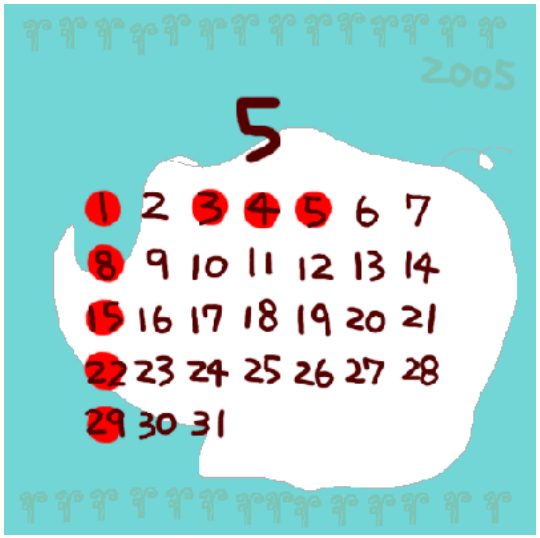
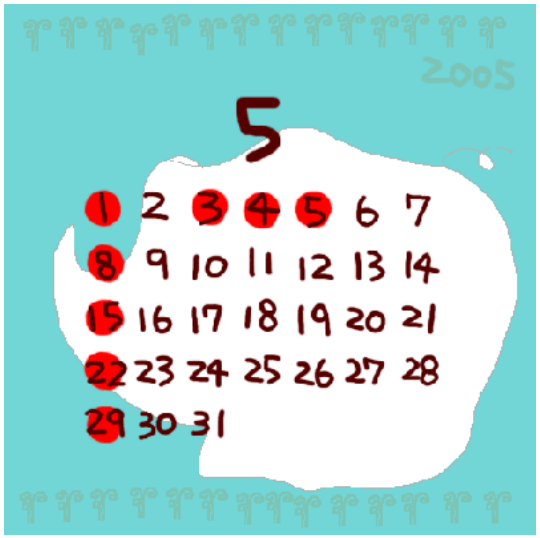
（第4分冊）

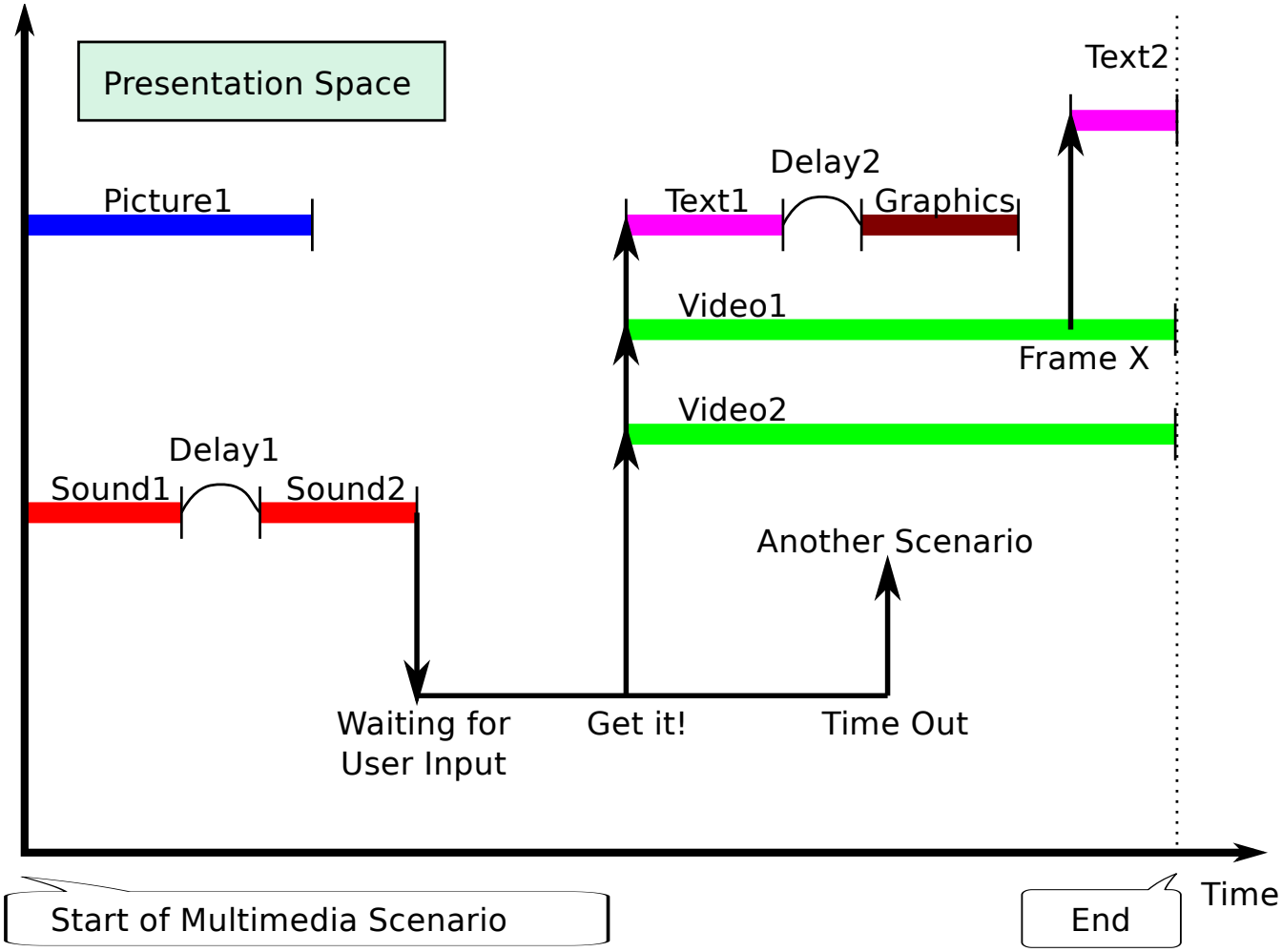
Multimedia情報例 (2/2)



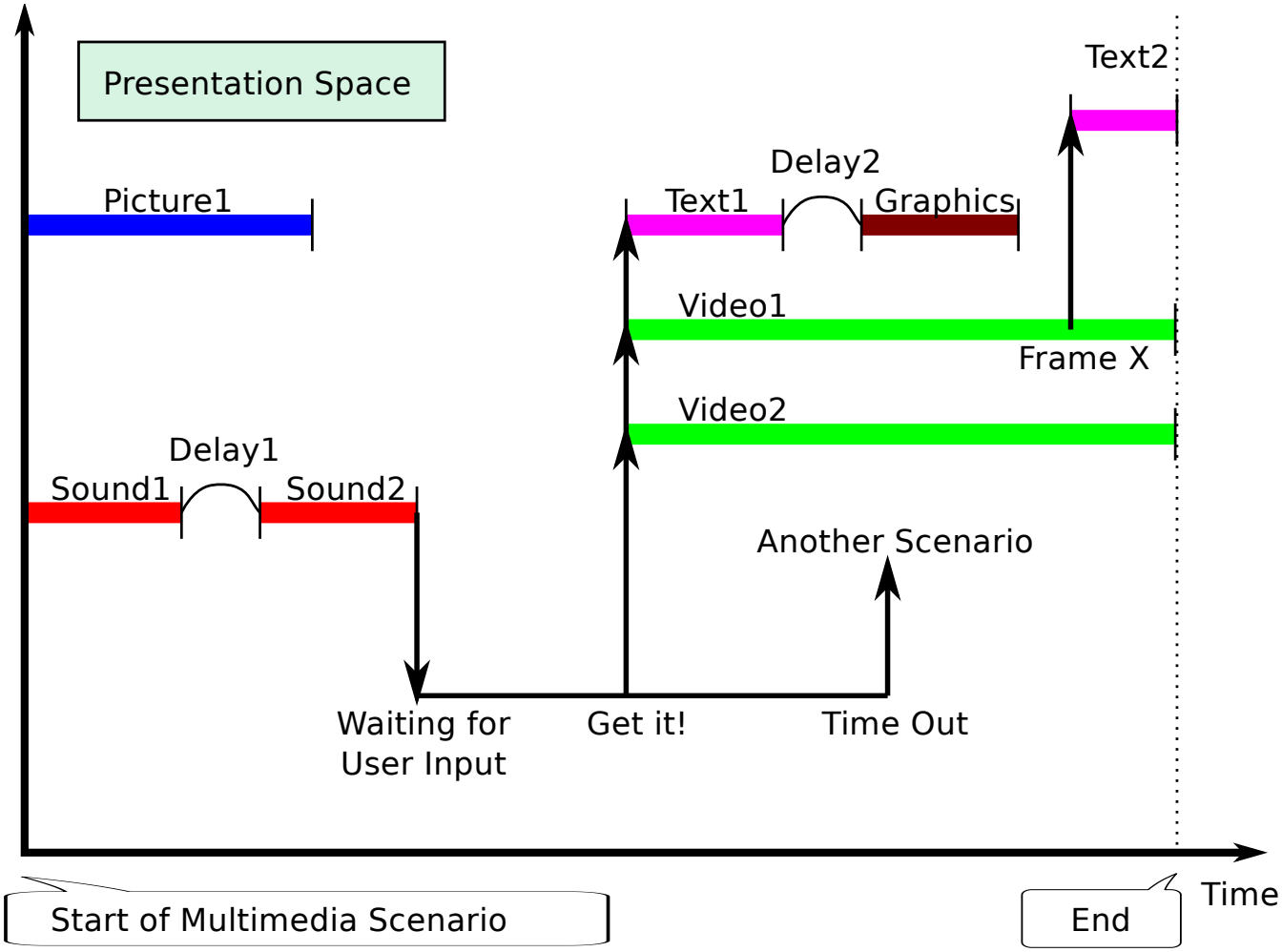
Examples of Multimedia Info (2/2)



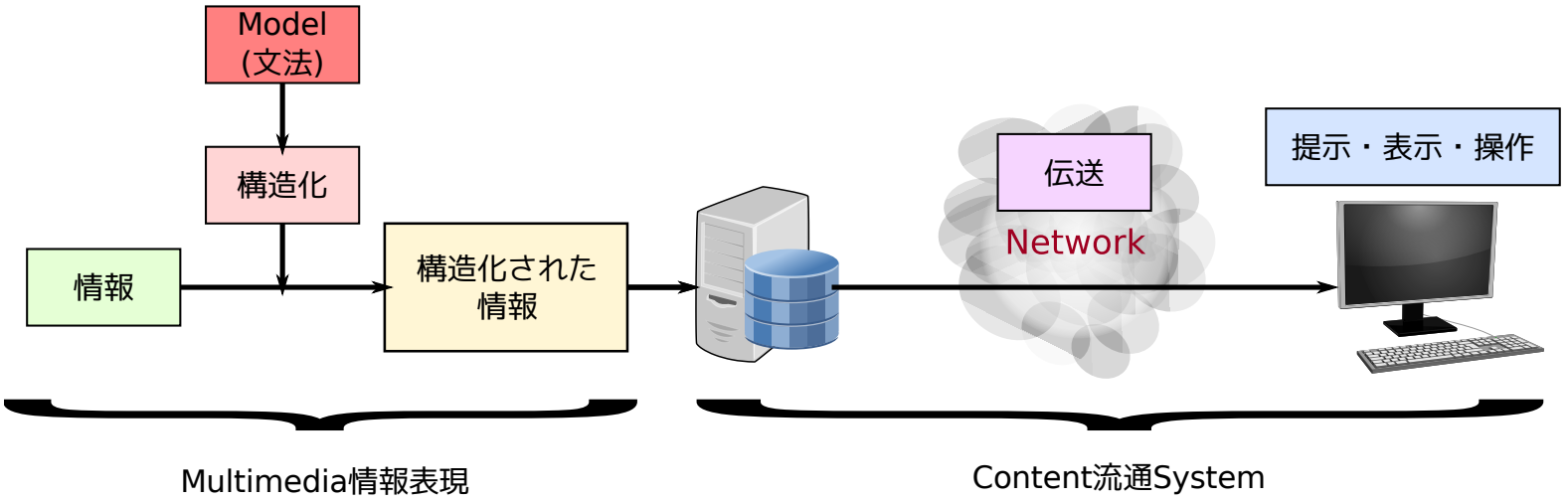
Multimedia Scenarioの例



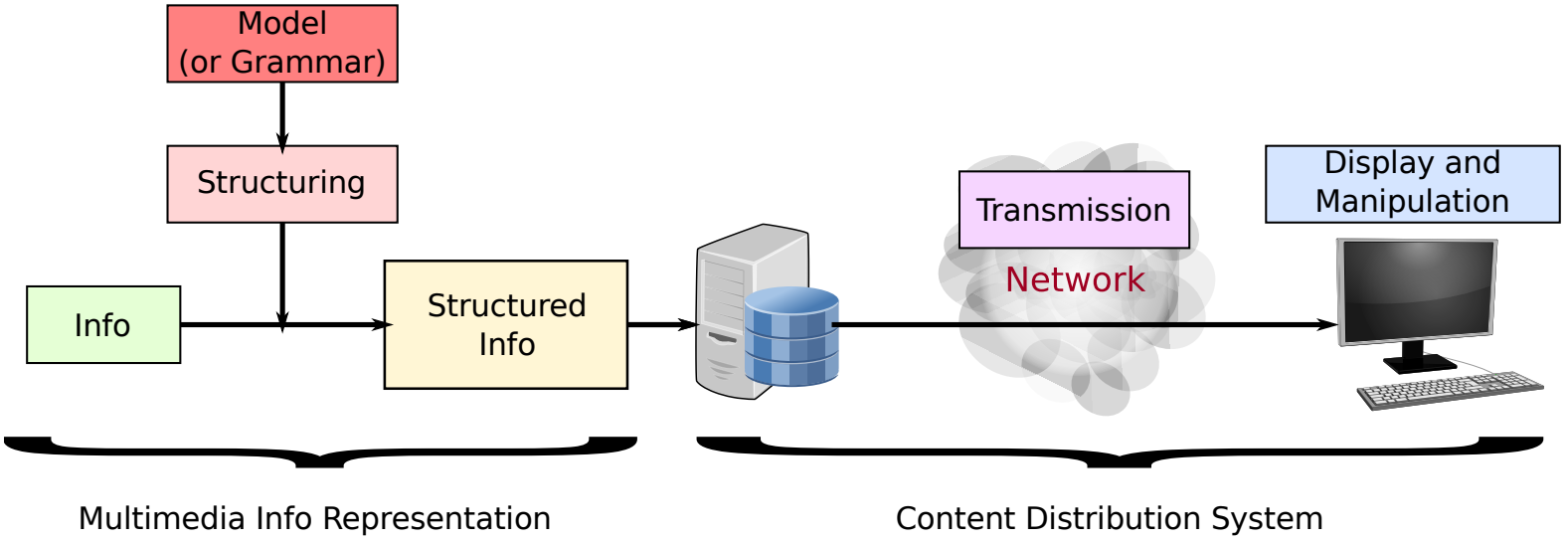
An Example of Multimedia Scenario



Multimedia情報表現とContent流通System



Multimedia Info Rep. and Content Distribution System



Multimedia情報表現に関する小史

1945年	Vanevar BushによるMemex構想
1960年代	Douglas Carl EngelbartによるMouseの発明とNLS (Online System)
1985年頃	ODA (ITU-T)
1985年頃	DVI (Intel)
1985年頃	CDI (Philips/SONY)
1988年頃	SGML (ISO/IEC JTC1)
1990年頃	HyTime (ISO/IEC JTC1)
1990年	WWWの誕生 (Tim Berners-Lee: CERN)
1995年	MHEG-5
1998年	XML, CSS, DOM, ECMAScript
1999年	BML
2009年	HTML5
.....	.....

Brief History on Multimedia Info Representation

1945	An Idea of "Memex" by Vanevar Bush
1960s	Invension of "Mouse" and NLS (Online System) by Douglas Carl Engelbart
1985	ODA (ITU-T)
1985	DVI (Intel)
1985	CDI (Philips/SONY)
1988	SGML (ISO/IEC JTC1)
1990	HyTime (ISO/IEC JTC1)
1990	Birth of WWW (Tim Berners-Lee: CERN)
1995	MHEG-5
1998	XML, CSS, DOM, ECMAScript
1999	BML
2009	HTML5
.....	.....

Memex

- Vanenar Bushが、1945年に文書とMicro-Film（Micro-Fiche）間のLinkを扱う、拡張記憶方式について論じた。
- つまり、Hypertext（Non-Linear Text）の概念を初めて発表した。
  - *論文で述べられているLinkは、Hyperlinkそのもの。*
- 但し、実現はしなかった。
- Hypertext Systemの祖と呼ばれている。

- http://www.w3.org/History/1945/vbush/

Memex

- Vanenar Bush published a paper in 1945, describing an idea of a human-memory extension system using micro-films (or micro-fiche) and links among them.
- The Memex is the first hypertext (or non-linear text) system ever known.
  - *The "link" he mentioned is exactly the hyperlink as we say today*
- However, it has not been implemented.
- With above reasons, he is called a father of Hypertext System.

- http://www.w3.org/History/1945/vbush/

ODA

- Office (Open) Document Architecture
- ISO/IEC JTC1とITU-Tによる文書の電子化規格
- Mixed Mode通信の主役と考えられていた。
- 考え方は先進的であり、世界各国の研究機関で研究が続けられたが、一般の理解を得る事はできなかった。

ODA

- Office (Open) Document Architecture
- An international standard for electronic documents by ISO/IEC JTC1 and ITU-T.
- Many people believed it would become a killer system.
- The concept or architecture was quite nice, so that many research institutes devoted their effort in investigating and developing.
- However, the system had never got the market.

DVI, CDI

- Digital Video Interactive (by Intel)
- Compact Disc Interactive (by Philips and SONY)
- CD-ROMが出始めたころ、これに何とかMultimedia Application を載せて流通させようという試みがあった。
- MPEG-1を生み出すきっかけとなった。

DVI, CDI

- Digital Video Interactive (by Intel)
- Compact Disc Interactive (by Philips and SONY)
- These were the trials on distribution of multimedia applications in the middle of 1980s when CD-ROMs came into the market.
- These were the driving force to make the MPEG-1 international standard.

SGML

- Standard Generalized Markup Language
- ISO/IEC JTC1によって標準化される。
- IBMのもっていたGMLの標準化版。
- Structured Data Representation Methodの本命に大化け。

- WWWの基本的な考えを提供。

SGML

- Standard Generalized Markup Language
- Standardized by ISO/IEC JTC1.
- A standardized version of GML invented by IBM.
- It has created a main stream of "Structured Data Representation Method".

- It provides the basis of WWW.

HyTime

- Hypermedia/Time-Based Structuring Language
- ISO/IEC JTC1によって標準化される。
- SGMLにLink機能、及び時間軸方向の拡張を与えるもの。
- 考え方は素晴らしいが、複雑過ぎた。。。

HyTime

- Hypermedia/Time-Based Structuring Language
- Standardized by ISO/IEC JTC1.
- Adding links and time axis to SGML.
- The design and concept are quite nice, but too complicated...

MHEG-5

- Multimedia Hypermedia Coding Expert Group (ISO/IEC JTC1/SC29/WG12)
- 全てのMultimedia情報をObjectとして表現し、Object間の同期・Event制御のMechanismを提供するMultimedia Scenario 記述方式。
- UKのDigital放送で利用されている。

MHEG-5

- Multimedia Hypermedia Coding Expert Group (ISO/IEC JTC1/SC29/WG12)
- A multimedia scenario describing method, representing all multimedia info as objects, and providing synchronization and control mechanisms among objects and events.
- Adopted in UK terrestrial digital broadcasting.

WWW

- Hypermedia SystemをInternet上で実現したものといえる。
- かつて様々なHypermedia Systemが提案された。
- なぜWWWがこれほどまでに受け入れられたのだろうか。

WWW

- An implementation of Hypermedia System on the Internet.
- So many hypermedia systems have been ever proposed.
- Why has WWW become so popular? Why WWW is so attractive?

XML

- Extensible Markup Language
- W3C (World Wide Web Consortium)による勧告
- 簡単にいうとSGMLのSubset。

XML

- Extensible Markup Language
- An recommendation by W3C (World Wide Web Consortium)
- Simply saying, a subset of SGML.

XML Schema

- XMLで記述するSchema記述言語
- Schemaとはなにか。
- XML DTDとの違いは何か。
- なぜXML Schemaを使用しなければならないのか。

XML Schema

- A schema language using XML
- What's "schema"?
- What's the difference from XML DTD?
- Why XML schema is to be used?

SMIL

- Synchronized Multimedia Integration Language
- XMLを利用してMultimedia Scenarioを記述する方式。
- SMILの利点と欠点は何だろうか。
- 何故、W3CはSMILの開発を止めると宣言したのだろうか。
  - *Synchronized Multimedia WG (SYMM WG) has been closed since April 1st, 2012.*

SMIL

- Synchronized Multimedia Integration Language
- A multimedia scenario describing method using XML.
- What are the pros and cons of SMIL?
- Why has W3C shutdown the development of SMIL?
  - Synchronized Multimedia WG (SYMM WG) is closed since April 1st, 2012.

BML

- 日本のDigital放送に使われるData放送方式。
- Broadcast Markup Language
- (社)電波産業会(通称ARIB)により作成される。
- XML + XHTML + DOM + CSS + ECMAScript + 放送用拡張
- WWWとは互換性はなく、これについて賛否両論あり。
- NHKが推進するHybridcastでは、HTML5を採用した。

BML

- A describing method used in digital broadcasting systems in Japan.
- Broadcast Markup Language
- Standardized by ARIB (Association of Radio Industries and Business), a subsidiary of the Ministry of Post and Telecommunications.
- No compatibilities between BML and WWW.
- HTML5 has been adopted in "Hybridcast" which is promoted by NHK and Japanese broadcast operators in replacement of BML.

まとめ

- 情報構造化の必要性
- 構造化をするための道具の必要性
- 構造化をするための情報Model構築の必要性

Wrap Up

- Necessity of information structuring
- Necessity of tools for information structuring
- Necessity of information model (information architecture) for structuring