

## WEB Trend

### 1. Introduction

Evolution of Computer Based Training

Global Standardization (SCORM)

### 2. Content Aggregation Model (CAM)

ASSET/SCO

Meta-data

Relationship to ID

Manifest File

### 3. Runtime Environment Model (RTE)

Communication/Transaction

Application Program Interface

Three core points for RTE

Document Object Model

Data model

Communication Session

### 4. Sequence and Navigation Model (SN, from 1.3)

Sequence and Navigation

Sequence and Navigation Description

Control Mode

Objective Description and Sequencing Rule

Rollup Rule

Overall Sequencing Process

### 5. Current LMS and issues

Major LMSs/SCORM Certificate system

Some issues from interoperability view point

## WBT Trend

- to keep interoperability
- to enable recycle
- to enable customization

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## Five Topics

### 1. Introduction

2. Content Aggregation Model (CAM)
3. Runtime Environment Model (RTE)
4. Sequence and Navigation Model (SN, from 1.3)
5. Current LMS and issues

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## 1.Introduction

- Evolution of Computer Based Training
- Global Standardization (SCORM)

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## Evolution of Computer-based Learning

- CAI
- CBT CD-ROM content
  - All contents and navigations are uniformly embedded.
  - Contents and Navigations could not be separated
  - No content module reusable
  - No partly upgrade
  - Navigation could not be restructured
  - Needs CD-ROM media distribution

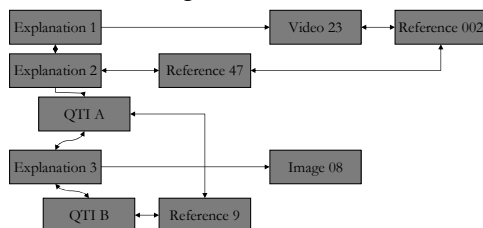
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## Non-structured contents

- Contents and navigations are embedded.



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## Evolution of Computer-based Learning

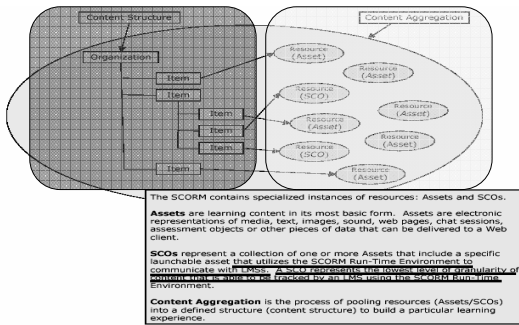
- Web-based (SCORM)  
(The Sharable Content Object Reference Model)
  - Contents and Navigations are independent
  - Content module reusable
  - Any content module could be upgraded
  - Navigation could be flexible by each trainee
  - Anybody could access through internet
- Needs broadband infrastructure

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## Content Aggregation



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## 1.Introduction

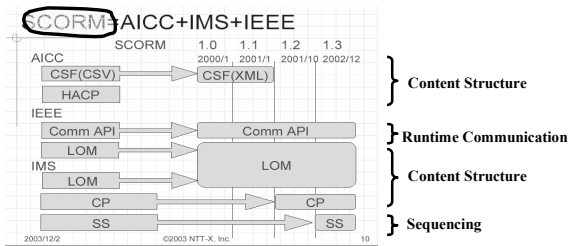
- Evolution of Computer Based Training
- **Global Standardization (SCORM)**

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## Global Standardization history



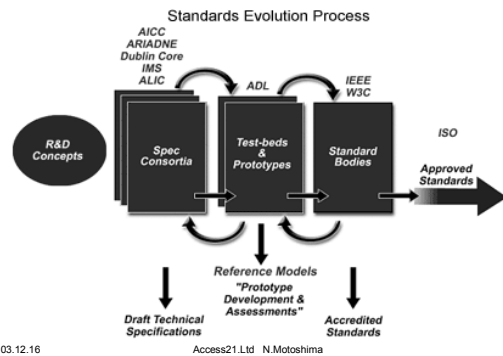
AICC: Aviation Industry CBT Committee  
 IEEE: Institute of Electrical and Electronics Engineers  
 IMS: IMS Global Consortium Inc.

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## Standard Evolution Process



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## SCORM

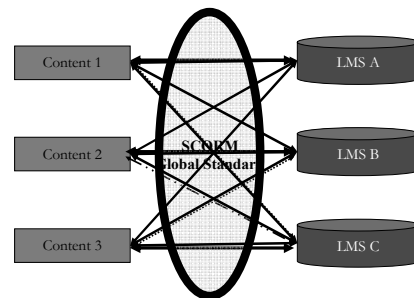
- The Sharable Content Object Reference Model
- The Department of Defense (DOD) established the **Advanced Distributed Learning (ADL)** Initiative in 1997 to use learning and information technologies to modernize education and training.
- SCORM affects/implements the instructional design and development process of a Web-based training, as well as how the designer or developer could approach course development

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## Role of Global Standard

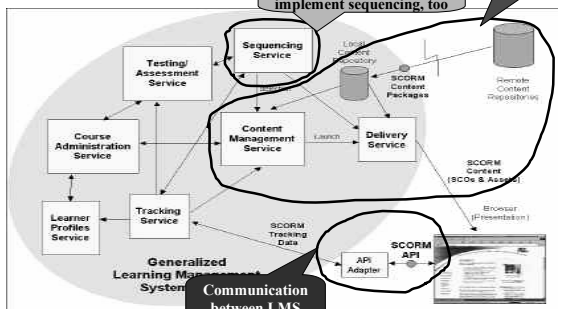


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## SCORM-based LMS overview



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## SCORM - three aspects

| SCORM Book                      | Concepts Covered   | Key SCORM Technology Covered  | Areas of Overlap  |
|---------------------------------|--|---|---|
| Overview                        | High-level conceptual information  | Incidental mention of numerous elements of SCORM terminology  | Covers areas of the SCORM RTE, CAM and SN books at a high-level   |
| Content Aggregation Model (CAM) | Assembling, labeling and packaging content   | SCO, Asset, Content Aggregation, Package, Package Interchange File (PIF), Meta-data, Manifest, Sequencing Information, Navigation Information | SCOs and manifests. SCOs communicate with an LMS via the RTE. Manifests contain Sequencing and Navigation information |
| Run-Time Environment (RTE)      | LMS Management of the Run-Time Environment which includes launch, content to LMS, communication, tracking, data transfer, error handling | API, API Instance, Launch, Session, Methods, Data Transfer Methods, Support Methods, Temporal Model, Run-Time Data Model                      | SCOs which are covered in the SCORM CAM book are content objects which use the RTE                                    |
| Sequencing and Navigation (SN)  | Sequencing content, navigation   | Activity Tree, Learning Activities, Sequencing Information, Navigation Information, Navigation Data Model                                     | Sequencing and Navigation affects how content is assembled in a manifest  |

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## Five Topics

1. Introduction

## 2. Content Aggregation Model (CAM)

3. Runtime Environment Model (RTE)

4. Sequence and Navigation Model (SN, from 1.3)

5. Current LMS and issues

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## 2. Content Aggregation Model (CAM)

- ASSET
- SCO
- Meta-data
- Relationship to ID
- Manifest File

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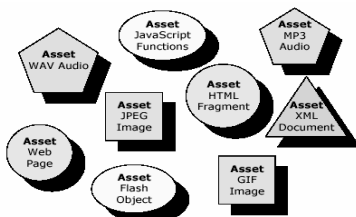
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## Asset

Assets is an electronic representation of media, such as text, images, sound or any other piece of data

- Minimum element
- No communication to LMS



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## Asset

- You could think it as an each sole courseware;
  - PowerPoint .ppt
  - Word .doc
  - Flash .fla
  - Image .jpg, .png
  - Video .mpg, .avi
  - Text e.t.c

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## 2. Content Aggregation Model (CAM)

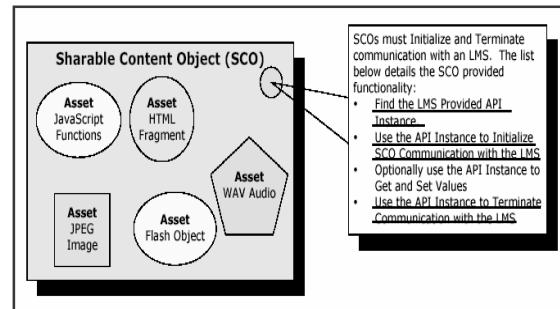
- ASSET
- **SCO**
- Meta-data
- Relationship to ID
- Manifest File

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## SCO

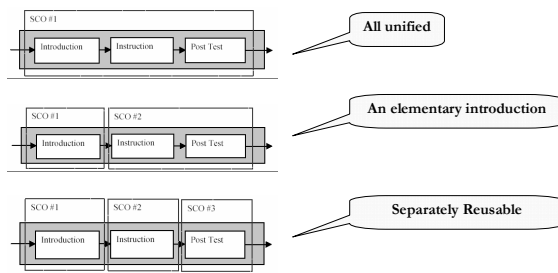


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## SCO construct



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## SCO's nature

- A statement of the objective, introductory material, an overview and/or advanced organizer  
⇒ **Attribute, location, organization**
- A unit of instruction or an instructional activity (tutorial, simulation or media experience)

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## SCO - LMS

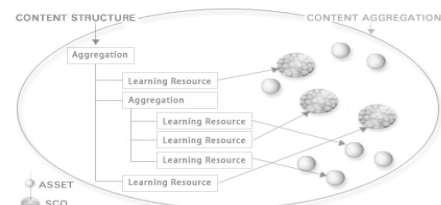
- Sharable Content Objects (SCOs) are learning activities that are delivered to the learner and "tracked" by a Learning Management System (LMS).
- SCOs represent a collection of one or more assets that utilize the SCORM Run-Time Environment (RTE) to communicate with the LMS.

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## Contents structure model



The SCORM Version 1.2 contains specialized instances of resources: Assets and SCOs. Assets are learning content in its most basic form. Assets are electronic representations of media, text, images, sound, web pages, chat sessions, assessment objects or other pieces of data that can be delivered to a Web client. SCOs represent a collection of one or more Assets and/or Shareable Resources that include a specific launchable asset that utilizes the SCORM Run-time Environment to communicate with LMSs. A SCO represents the lowest level of granularity of content that is able to be tracked by an LMS using the SCORM Run-time Environment. Content Aggregation is the process of aggregation resources (SCOs/Assets) into a defined structure (content structure) to build a particular learning experience.

[http://www.teleologic.net/SCORM/images/scorm\\_graphic\\_b\\_screen3.jpg](http://www.teleologic.net/SCORM/images/scorm_graphic_b_screen3.jpg)

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## 2. Content Aggregation Model (CAM)

- ASSET
- SCO
- **Meta-data**
- Relationship to ID
- Manifest File

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## Meta-data

- 1. General – information that describes the resource as a whole
- 2. Lifecycle – features related to the history and current state of the resource and the individuals who have created the resource
- 3. Meta-metadata – information about the meta-data record
- 4. Technical – technical requirements and characteristics of the resource
- 5. Educational – educational characteristics of the resource
- 6. Rights – intellectual property rights and conditions of use for the resource
- 7. Relation – the relationship between this resource and other targeted resources
- 8. Annotation – comments on the educational use of the resource and information on when and by whom the comments were created
- 9. Classification – where this resource falls within a particular classification
  - Applied for SCO and Asset

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## 1. General

| NR    | Name          | Explanation   | Mandatory |
|-------|---------------|---|-----------|
| 1     | General       | Describes the resource as a whole.  | Y         |
| 1.1   | Identifier    | Globally Unique label that identifies the resource.   | Y         |
| 1.2   | Title         | Name given to the asset.  | Y         |
| 1.3   | Catalog Entry | Sub-category that defines an entry within a catalog assigned to the resource.   | N         |
| 1.3.1 | Catalog       | The name of the catalog.  | N         |
| 1.3.2 | Entry         | Actual value of the entry within the catalog.   | N         |
| 1.4   | Language      | Language used with this asset to communicate to the intended user.  | N         |
| 1.5   | Description   | Textual description of the asset.   | Y         |
| 1.6   | Keyword       | Keywords or phrases describing the asset.   | N         |
| 1.7   | Coverage      | The span or extent of such things as time, culture, geography or region that applies to the resource.   | N         |
| 1.8   | Structure     | Underlying structure of the asset: <ul style="list-style-type: none"> <li>• Collection</li> <li>• Mixed</li> <li>• Linear</li> <li>• Hierarchical</li> <li>• Networked</li> <li>• Branched</li> <li>• Parceled</li> <li>• Atomic</li> </ul> | N         |

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## 2. Lifecycle

| 2.0   | Lifecycle  | Describes the history and current state of the asset.   | N |
|-------|------------|---|---|
| 2.1   | Version    | The edition of the asset.   | N |
| 2.2   | Status     | The state of the asset: <ul style="list-style-type: none"> <li>• Draft</li> <li>• Final</li> <li>• Revised</li> <li>• Unavailable</li> </ul>  | N |
| 2.3   | Contribute | People or organizations that have affected the state of the asset.  | N |
| 2.3.1 | Role       | List one only: <ul style="list-style-type: none"> <li>• Author</li> <li>• Publisher</li> <li>• Unknown</li> <li>• Initiator</li> <li>• Terminator</li> <li>• Validator</li> <li>• Editor</li> <li>• Graphical Designer</li> <li>• Technical implementer</li> <li>• Content Provider</li> <li>• Technical Validator</li> <li>• Educational Validator</li> <li>• Script Writer</li> <li>• Instructional Designer</li> </ul> | N |
| 2.3.2 | Entity     | The identification and information about the people or organizations contributing to this resource.   | N |
| 2.3.3 | Date       | Date of contribution.   | N |

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## 4. Technical

| 4.0   | Technical                   | Describes the technical requirements and characteristics of this resource.  | Y |
|-------|-----------------------------|---|---|
| 4.1   | Format                      | Technical data types that identify the software needed to access the resource. The string is restricted to either a MIME type or "non-digital". | Y |
| 4.2   | Size                        | The size of the digital resource in bytes.  | N |
| 4.3   | Location                    | A string that is used to access this resource. It may be a location URL or a method that resolves to a location URL.                            | Y |
| 4.4   | Requirement                 | Describes the technical capabilities required to use this resource.   | N |
| 4.4.1 | Type                        | The technology required to use this resource.   | N |
| 4.4.2 | Name                        | Name of the required technology to use resource.  | N |
| 4.4.3 | Minimum Version             | Lowest possible version of the required technology to use this resource.  | N |
| 4.4.4 | Maximum Version             | Highest version of the technology known to support the use of this resource.  | N |
| 4.5   | Installation                | Description of how to install this resource.  | N |
| 4.6   | Other Platform Requirements | Information about other software and hardware.  | N |
| 4.7   | Duration                    | Time continuous resource takes when played at intended speed.   | N |

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## 5. Educational

| 5.0  | Educational            | Describes the key educational or pedagogical characteristics of this resource.  | N |
|------|------------------------|---|---|
| 5.1  | Interactivity          | The flow of interaction between the resource and the intended user.   | N |
| 5.2  | Learning Resource Type | Specific kind of resource: <ul style="list-style-type: none"> <li>• Exercise</li> <li>• Questionnaire</li> <li>• Figure</li> <li>• Team</li> <li>• Problem statement</li> <li>• Simulation</li> <li>• Diagram</li> <li>• Graph</li> <li>• Slide</li> <li>• Narrative text</li> <li>• Experiment</li> <li>• Self-assessment</li> </ul>   | N |
| 5.3  | Interactivity Level    | Defines the degree of interactivity between the user and this resource: <ul style="list-style-type: none"> <li>• Very low</li> <li>• Low</li> <li>• Medium</li> <li>• High</li> <li>• Very high</li> </ul>  | N |
| 5.4  | Semantic density       | Defines a subjective measure of the resource's usefulness compared to its size or duration: <ul style="list-style-type: none"> <li>• Low</li> <li>• Medium</li> <li>• High</li> <li>• Very high</li> </ul>  | N |
| 5.5  | Intended and user role | Principal users for which the resource was designed: <ul style="list-style-type: none"> <li>• Teacher</li> <li>• Author</li> <li>• Learner</li> <li>• Manager</li> </ul>  | N |
| 5.6  | Context                | Principal environment within which the learning and use of the resource is intended to take place: <ul style="list-style-type: none"> <li>• Primary education</li> <li>• Secondary education</li> <li>• Higher education</li> <li>• University first-cycle</li> <li>• University second cycle</li> <li>• University postgraduate</li> <li>• Technical school diploma/cycle</li> <li>• Technical school second cycle</li> <li>• Professional formation</li> <li>• Continuous formation</li> <li>• Vocational training</li> </ul> | N |
| 5.7  | Typical age range      | Age range of the typical user.  | N |
| 5.8  | Difficulty             | Level of difficulty for the typical target audience to complete the resource successfully: <ul style="list-style-type: none"> <li>• Very easy</li> <li>• Easy</li> <li>• Medium</li> <li>• Difficult</li> <li>• Very difficult</li> </ul>   | N |
| 5.9  | Typical learning time  | Approximate of typical time it takes to work with this resource.  | N |
| 5.10 | Description            | Comments on how this resource is to be used.  | N |
| 5.11 | Language               | The language used by the typical audience.  | N |

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## 6. Right, 7. Relation

|     |                                  |  |   |
|-----|----------------------------------|--|---|
| 6.0 | Rights                           | Describes the intellectual property rights and conditions used for this resource.  | Y |
| 6.1 | Cost                             | Whether use of the resource requires payment.  | Y |
| 6.2 | Copyright and other restrictions | Whether copyright or other restrictions apply to the use of this resource.   | Y |
| 6.3 | Description                      | Comments on the conditions of this resource.   | N |
| 7.0 | Relation                         | Defines the relationship between this resource and other resources, if any.  | N |
| 7.1 | Kind                             | Nature of the relationship between this resource and the target resource (identified by 7.2, relation resource): <ul style="list-style-type: none"> <li>• Ispartof</li> <li>• Haspart</li> <li>• Inversionof</li> <li>• Hasversion</li> <li>• Isformatof</li> <li>• Hasformat</li> <li>• References</li> <li>• Isreferencedby</li> <li>• Isbasedon</li> <li>• Isbasison</li> <li>• Isbasisfor</li> </ul> | N |

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## 2. Content Aggregation Model (CAM)

- ASSET
- SCO
- Meta-data
- **Relationship to ID**
- Manifest File

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## Instruction Design

- The way of Boeing
- **Phase 1 Analysis**
  - Step1 Determine the business need
  - Step2 Analyze what's to be learned
- **Phase 2 Design**
  - Step3 Define learning objectives
  - Step4 Develop assessments
  - Step5 Develop learning solutions
  - Step6 Select Presentation methods

What did you learn?

What you can do?  
What can you make?  
How to evaluate it?  
(Competency)

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## Instruction Design

- **Phase 3 Develop**
  - Step7 Acquire/Produce materials
  - Step8 Test and revise
- **Phase 4 Deliver**
  - Step9 Deploy and publish the training
- **Phase 5 Evaluate**
  - Step10 Revise the training

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## Instruction Design

- Analysis, SOW, TFEA, Assemble Production Team 40%
- Design, GUI, Interactivity, Assessments, Storyboard 20%
- Template Design, Author 20%
- Produce medias 14%
- Testing, Alpha-Beta, Usability 6%

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## Relationship to ID

- Analysis
- Goal setting
- Evaluation Method
- Design structure/Navigation
- Develop contents
- Implement contents into system
- Evaluation



LOM

-General  
-Lifecycle  
-Technical  
-Educational  
-Right  
etc

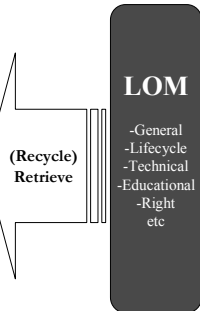
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## Relationship to ID

- Analysis
- Goal setting
- Evaluation Method
- Design structure/Navigation
- Develop contents
- Implement contents into system
- Evaluation



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## 2. Content Aggregation Model (CAM)

- ASSET
- SCO
- Meta-data
- Relationship to ID
- **Manifest File**

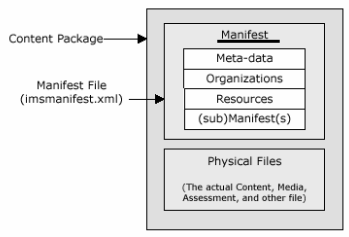
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## Content package component

A Special XML document describes the structure and recurses of the package. This special file is called as the MANIFEST file "imsmanifest.xml".

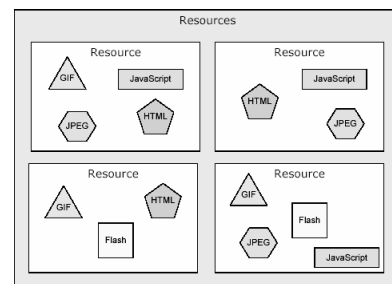


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## Resources



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## Manifest File

```

<organizations>
  <organization identifier="TOCI1">
    <title> Introduction to SCORM for IMS Vendors </title>
    <item identifier="ITEM1" identifierref="RESOURCE1" invisible="true">
      <title>SCORM Run-Time Environment Requirements</title>
    </item>
    <item identifier="ITEM2" identifierref="RESOURCE2" invisible="true">
      <title>IMS Conformance Requirements</title>
    </item>
  </organization>
</organizations>

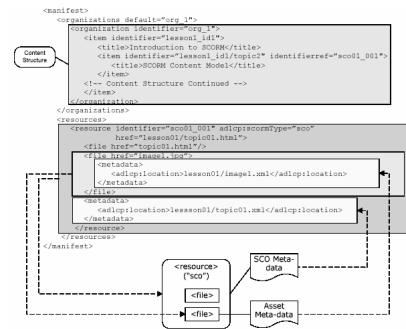
<manifest>
  <metadata/>
  <organizations/>
  <resources>
    <resource identifier="RESOURCE1" type="webcontent" href="lesson1.htm">
      <file href="lesson1.htm"/>
    </resource>
    <resource identifier="RESOURCE2" type="webcontent" href="introl.htm">
      <file href="introl.htm"/>
    </resource>
    <resource identifier="RESOURCE3" type="webcontent" href="content1.htm">
      <file href="content1.htm"/>
    </resource>
    <resource identifier="RESOURCE4" type="webcontent" href="summary1.htm">
      <file href="summary1.htm"/>
    </resource>
  </resources>
</manifest>
  
```

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## Manifest File, Meta-data File



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## SCO – LMS (summary)

- A SCO and an asset, can be described **with meta-data to allow for search and discovery** by providing descriptive information about the content represented in the SCO. With the use of meta-data, SCOs can become searchable within content repositories, thereby enhancing opportunities for reuse.
- Meta-data regard SCO is **an implementation of instructional design**
- SCOs are learning activities that are delivered to the learner and **“tracked” by a LMS**. SCOs represent a collection of one or more assets that utilize the SCORM Run-Time Environment (RTE) to communicate with the LMS.
- **SCO sample**

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## Demo

- Tool Instructor
- Vender Click2learn  
<http://home.click2learn.com/>

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## Five Topics

1. Introduction
2. Content Aggregation Model (CAM)
- 3. Runtime Environment Model (RTE)**
4. Sequence and Navigation Model (SN, from 1.3)
5. Current LMS and issues

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## 3. Runtime Environment Model (RTE)

- **Communication/Transaction**
- Application Program Interface
- Three core points for RTE
  - Document Object Model
  - Data model
  - Communication Session

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## Communication between contents (SCO) and system (LMS)

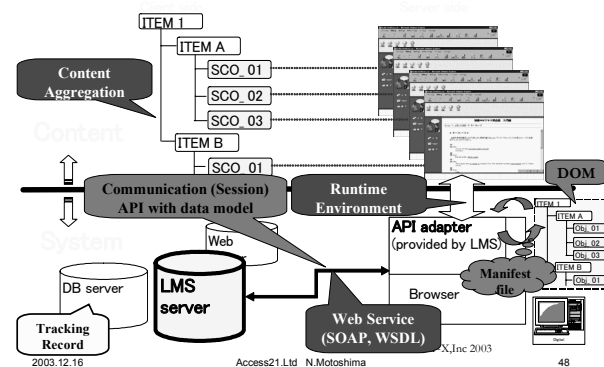
- Application layer communication
- Various methods to make a communication
  - http protocol
  - Perl, Php, PL/SQL etc
  - **JAVA Class : processing in Client**
  - **Web services (SOAP, WSDL) : communication between Client & Server**

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## Runtime transaction

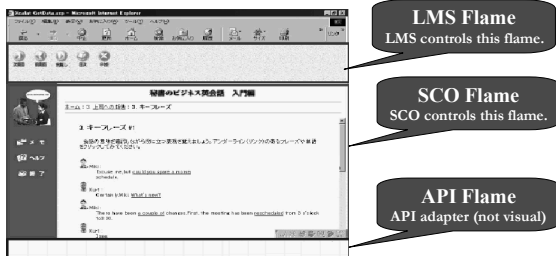


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## Client interface



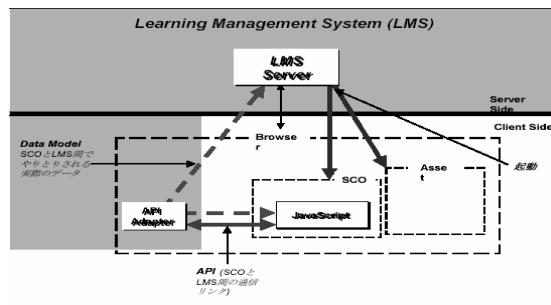
NTT-X, Inc, 2003

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## LMS communication to SCO



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## 3. Runtime Environment Model (RTE)

- Communication/Transaction
- **Application Program Interface**
- Three core points for RTE
  - > Document Object Model
  - > Data model
  - > Communication Session

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## Application Program Interface (API)

- The API defines a standardized means for SCOs to communicate with the LMS.
  - The LMS does not initiate communications; SCO resources initiate all communication to the API adapter (DOM object, instance).
  - The API makes communication with parameters of the data model elements to the LMS.
  - SCOs will communicate with the API via JavaScript calls. JavaScript is the common thread between SCOs and LMSs.
- > [API Sample1](#)

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## LMS responsibility

- SCO requests LMS to provide API instance as defined by SCORM (IEEE)
- LMS provides API instance which has a common name
- The API shield SCO from the particular implementation detail.
- LMS must launch SCO in a window which should be a child/frame window of LMS that contains API instance.
- **Record learner's history**

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## SCO responsibility

- SCO must be able to find API instance (API must be downloaded before SCO download!)
- SCO communicates to LMS through API
- **Courseware, Supplemental materials, teaching note, question, answer, scoring logic**

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### 3. Runtime Environment Model (RTE)

- Communication/Transaction
- Application Program Interface
- Three core points for RTE

#### > Document Object Model

- > Data model
- > Communication Session

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### DOM Definition

- The Document Object Model is a platform-and-language neutral interface that will allow programs and scripts to **dynamically access and update the content, structure and style of documents.**
- The document can be further processed and the results of that processing can be incorporated back into the presented page.

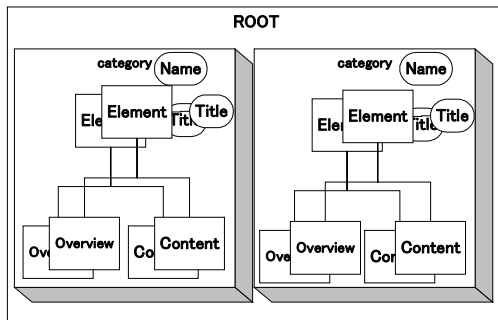
(W3C Definition, in a huge specification of DOM)  
<http://www.w3.org/DOM/>

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### Content Structure



Content structure is defined by sample.xml

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### DOM utilization- sample

```

.....
public class DomSample {
    /**
     * Start Class
     */
    public static void main(String[] args) {
        try {

            // Create Document
            DocumentBuilderFactory dbfactory =
                DocumentBuilderFactory.newInstance();
            DocumentBuilder builder = dbfactory.newDocumentBuilder();
            Document doc = builder.parse(new File("sample.xml"));

            // Get root element
            Element root = doc.getDocumentElement();
            System.out.println("Tag name of element:" + root.getTag());
        }
    }
}
  
```

- Method : tool to make process  
 - Valuable(Instance) : vessel to keep values  
 - Instance hold some specific methods

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### DOM utilization- sample

```

// Get node list of each Category element, make a process for each node
NodeList categoryList = root.getElementsByTagName("Category");
for (int i = 0; i < categoryList.getLength(); i++) {
    Element categoryElement = (Element)categoryList.item(i);
    String categoryName = categoryElement.getAttribute("Name");

    // Get node list of each Element, make a process for each node
    NodeList elementList =
        categoryElement.getElementsByTagName("Element");
    for (int j = 0; j < elementList.getLength(); j++) {
        Element elementElement = (Element)elementList.item(j);
        String title = elementElement.getAttribute("Title");

        // Get the value of overview element
        NodeList overviewList =
            elementElement.getElementsByTagName("Overview");
        Element overviewElement = (Element)overviewList.item(0);
        String overview =
            overviewElement.getFirstChild().getNodeValue();
    }
}
  
```

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### DOM utilization - sample

```

// Get the value of Contents elements
NodeList contentsList =
    elementElement.getElementsByTagName("Contents");
Element contentsElement = (Element)contentsList.item(0);
String contents =
    contentsElement.getFirstChild().getNodeValue();

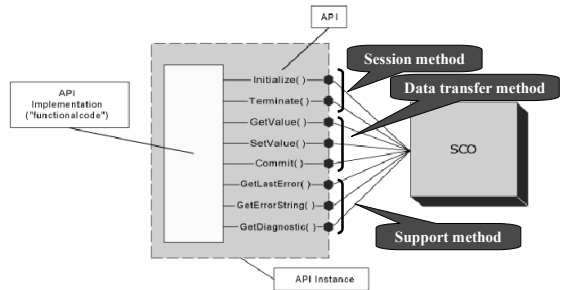
// Print the value
System.out.println("-----");
System.out.println("Category = " + categoryName);
System.out.println("Title = " + title);
System.out.println("overview = " + overview);
System.out.println("contents = " + contents);
}
}
} catch (Exception ex) {
    System.out.println(ex.getMessage());
    ex.printStackTrace();
}
}
}
  
```

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## API in RTE



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## Initialize

**Method Syntax:** `return_value = Initialize(parameter)`

**Description:** The function is used to initiate the communication session. It allows the LMS to handle LMS specific initialization issues.

**Parameter:** ("") – empty characterstring. An empty characterstring shall be passed as a parameter.

**Return Value:** The function can return one of two values. The return value shall be represented as a characterstring. The quotes (") are not part of the characterstring returned, they are used purely to set off the values returned.

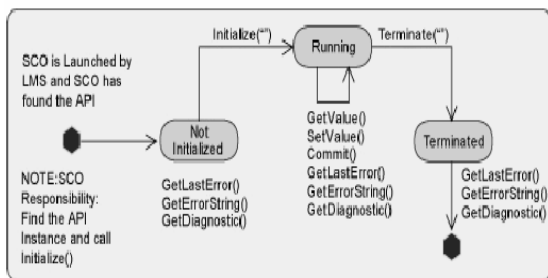
- "true" – The characterstring "true" shall be returned if communication session initialization, as determined by the LMS, was successful.
- "false" – The characterstring "false" shall be returned if communication session initialization, as determined by the LMS, was unsuccessful. The API Instance shall set the error code to a value specific to the error encountered. The SCO may call `GetLastError()` to determine the type of error. More detailed information pertaining to the error may be provided by the LMS through the `GetDiagnostic()` function.

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## API instance transition



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## Merit of Standardized DOM

- Don't need to make a specific programming to accomplish a specific task
- SCO could communicate to any LMSs which provide with Standardized API instance

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## 3. Runtime Environment Model (RTE)

- Communication/Transaction
- Application Program Interface
- Three core points for RTE
  - Document Object Model
  - **Data model**
  - Communication Session

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## Data model

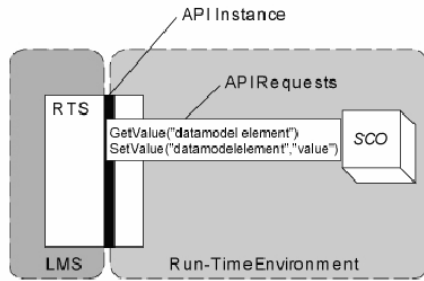
- A set of standardized parameter of API methods, for example;
  - Number of learners
    - ✓ `GetValue("cmi.comments_from_learner_count")`
  - Record the response from a learner
    - ✓ `SetValue("cmi.interactions.0.learner_response", "true")`

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## Data Model in API



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## A sample of data model description

| Dot-Notation Binding | Details   |
|----------------------|---|
| cmi.learner_id       | <p><b>Data Element Implementation Requirements</b></p> <ul style="list-style-type: none"> <li><b>Data Type:</b> con_obj_com_object_identifier</li> <li><b>Value Space:</b> A character string (SP4: 4000) that represents a valid Universal Resource Identifier (URI) as per RFC 2396 [6]. It is recommended that the URI be a Universal Resource Name (URN) as per RFC 2141 [5].</li> <li><b>Format:</b> A URI must conform to the syntax defined in RFC 2396. A URN is a special case of a URI. All URNs are required to have the following syntax (brackets in spaces are required):<br/>                     &lt;LRN&gt; := "urn:"&lt;NID&gt;":"&lt;NSS&gt;"<br/>                     where &lt;NID&gt; is the Namespace Identifier and &lt;NSS&gt; is the Namespace Specific String [3].</li> </ul> <p><b>LMS Behavior Requirements</b></p> <ul style="list-style-type: none"> <li>This element is mandatory and shall be implemented by an LMS as read-only.</li> <li>The LMS shall be responsible for initializing the cmi.learner_id. How this is done is currently outside the scope of the SCORM (e.g., this is typically handled via a learner registration system within the LMS).</li> </ul> <p><b>SCO Behavior Requirements</b></p> <ul style="list-style-type: none"> <li>This element is required to be implemented by an LMS as read-only. The SCO only has the ability to retrieve this value (GetValue).</li> <li>The SCO is not permitted to invoke the SetValue() request for this data model element.</li> </ul> <p><b>API Implementation Requirements</b></p> <ul style="list-style-type: none"> <li><b>GetValue:</b> The LMS shall return the associated learner identifier currently maintained by the LMS for the learner and set error code to "0" - No error. The character string returned shall adhere to the requirements identified in the Data Element Implementation Requirements.</li> <li><b>SetValue:</b> If the SCO invokes a SetValue() request to set the cmi.learner_id, then the LMS shall set the error code to "101" - Data model element is read only and return "false". The LMS shall not alter the state of the element based on the request.</li> </ul> <p><b>Example</b></p> <ul style="list-style-type: none"> <li>GetValue("cmi.learner_id")</li> </ul> |

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## Interactions

- cmi.interactions\_children  
Get a list of supported data model elements (node)
  - cmi.interactions\_count  
Get the number of interactions
  - cmi.interactions.n.id  
> SetValue("cmi.interactions.4.id", "Question 5")
  - cmi.interactions.n.type true/false, multiple, choice, fill\_in, matching etc  
> SetValue("cmi.interactions.3.type", "true-false")
  - cmi.interactions.n.objectives.n.id  
> GetValue("cmi.interaction.2.objectives.0.id")
  - cmi.interactions.n.correct\_response\_count  
> GetValue("cmi.interactions.n.correct\_response\_count") etc
- } A kind of Prefix

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## Comments from learner

- cmi.comments\_from\_learner\_children  
Get a list of supported data model elements (node)
- cmi.comments\_from\_learner\_count  
Get the number of learner comments
- cmi.comments\_from\_learner.n.comment  
> GetValue("cmi.comments\_from\_learner.2.comment")
- cmi.comments\_from\_learner.n.data\_time  
> SetValue("Cmi.comments\_from\_learner.n.data\_time", "2003-07-21T04:01:45")

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## Objectives

- cmi.objectives\_children  
Get a list of supported data model elements (node)
  - cmi.objectives\_count  
Get the number of objectives
  - cmi.objectives.n.score\_scaled  
> Performance of learners for the objective -1 to 1  
> SetValue("cmi.objectives.0.score\_scaled", "0.7345")
  - cmi.objectives.n.score\_min  
> Minimum value  
> SetValue("cmi.objectives.0.score\_min", "10")
  - cmi.objectives.n.success\_status  
> Passed, failed, unknown  
> SetValue("cmi.objectives.0.success\_status", "failed")
  - cmi.objectives.n.completion\_status  
> Completed, incomplete, not\_attempt, unknown  
> SetValue("cmi.objectives.0.completion\_status", "incomplete")
- } Related to Sequencing

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## Score

- cmi.score\_children
- cmi.score.scaled value is -1 to 1  
> SetValue("cmi.score.scaled", "0.56")
- cmi.score.raw real number value  
> SetValue("cmi.score.raw", "72")
- cmi.score.max real number value  
> SetValue("cmi.score.max", "300")
- cmi.score.min real number value  
> SetValue("cmi.score.min", "1")

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## Others

- **cmi.completion\_status**
  - complete, imcomplete, not\_attempted, unknown
  - > SetValue("cmi.completion\_status","imcomplete")
- **cmi.credit** pass or fail
  - > GetValue("cmi.credit")
- **cmi.entry** previous access to SCO
  - > GetValue("cmi.entry")
- **cmi.exit** time out, log out, suspend
  - > SetValue("cmi.exit", "suspend")
- **cmi.learner\_name**
  - > GetValue("cmi.learner\_name")

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## Others

- **cmi.scaled\_passing\_score**
  - > GetValue("cmi.scaled\_passing\_score")
- **cmi.success\_status** passed, failed, unknown
  - > SetValue("cmi.success\_status","passed")
- **cmi.learner\_id**
  - > GetValue("cmi.learner\_id")
- **cmi.time\_limit\_action** exit\_message, continue\_message, exit\_no\_message, continue\_no\_message
  - > SetValue("cmi.time\_limit\_action", exit\_message)
- **cmi.session\_time**
  - > SetValue("cmi.session\_time","PT1H5M")
- **cmi.total\_time**
  - > GetValue("cmi.total\_time")

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## Responding to error

Error happens!! Response should be written to direct

1. Already initialized, Termination failure, Termination before initialized, retrieve data after terminate, store data before initialized, etc
2. General argument error, get/set/commit error, etc
3. Undefined data model, unimplemented data model, read only/write only, out of range, type mismatch, etc
4. Element does not have a child/parent, etc

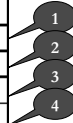
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## Error code

| Error Code Category           | Error Code Range |
|-------------------------------|------------------|
| No Error                      | 0                |
| General Errors                | 100 – 199        |
| Syntax Errors                 | 200 – 299        |
| RTS Errors                    | 300 – 399        |
| Data Model Errors             | 400 – 499        |
| Implementation-defined Errors | 1000 - 65535     |



SCORM - RTE specification

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## 3. Runtime Environment Model (RTE)

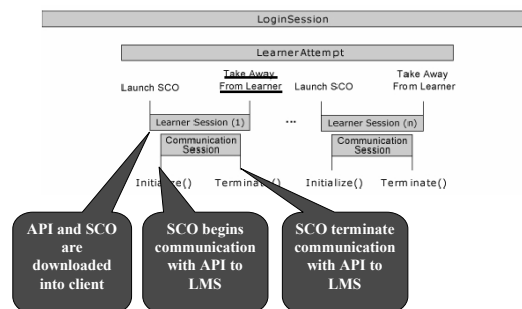
- Communication/Transaction
- Application Program Interface
- Three core points for RTE
  - > Document Object Model
  - > Data model
  - > **Communication Session**

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## Communication Session

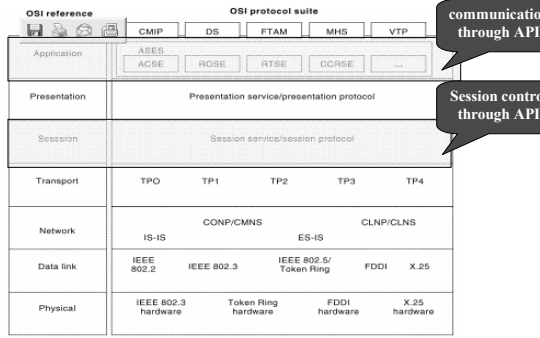


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## Communication Protocol



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## Session Control Programming (PHP)

### Cookie

```

<form action="" method="post">
<input type="text" name="userName" value="">
<input type="submit" value="send">
</form>
<?php
if($_POST['userName']) {
    setcookie ("userName", SuserName,time()+60*60*24*30);
}
if($_COOKIE['userName']) {
    echo "Hello".$_COOKIE['userName'].", Welcome! again!";
} elseif($_POST['userName']) {
    echo "Hello".$_POST['userName'].", Welcome!";
}
?>
    
```

Setcookie function which set cookie  
\$\_COOKIE array which covers cookie information

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## Session Control Programming (PHP)

```

<?php
> session_set_cookie_params(0,~/JICA/php/");
> session_name("Lonin");
> session_start();
<?>
<form action="ses1.php?<?php echo strip_tags(SID)>" method="post">
<p>message: <input name="msg">
</form>
<?php
if($_POST['msg']) {
    $_SESSION['msgs'] = htmlspecialchars($_POST['msg']);
    $_SESSION['msgs'] .= "\n";
}
if($_SESSION['msgs']) {
    echo "<p>past message:\n";
    echo $_SESSION['msgs'];
}
?>
    
```

\$\_POST, \$\_SESSION Array which covers POST data, Session data

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## Session Control Programming (JAVA)

### Set session

```

.....
public class HelloWorldStartSession extends HttpServlet {
//HTTP request control
public void service(HttpServletRequest request,
HttpServletResponse response)
throws ServletException, IOException {
// Start session
HttpSession session = request.getSession(true);
// set attribute to session
session.setAttribute("MESSAGE", "Hello World");
session.setAttribute("DATE", new Date());
response.setContentType("text/html; charset=Shift_JIS");
}
}
> API Sample1
    
```

- Method : tool to make process  
- Valueable(Instance) : vessel to keep values  
- Instance hold some specific methods

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## Session Control Programming (JAVA)

```

Check session
.....
public class HelloWorldTestSession extends HttpServlet {
//HTTP request
public void service(HttpServletRequest request,
HttpServletResponse response)
throws ServletException, IOException {
// Get session
HttpSession session = request.getSession(false);
String msg;
if(session == null) { // No Session
msg = "No Session!";
} else { // There is a Session
// Get Session data
String message = (String)session.getAttribute("MESSAGE");
Date date = (Date)session.getAttribute("DATE");
msg = "There is a session!<br>" +
"Message recorded in session is <br>" + .... "<br>" + message + "<br>" +
"Session start time is " + date.toString();
}
}
}
    
```

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## Session Transaction

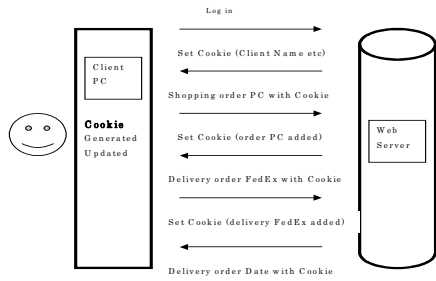
- While you login, this login status continues during your surfing. How it comes?, because HTTP session (Layer 4) closes every request/response.
- "Cookie"
  - Cookies are a general mechanism which server side connections (such as CGI scripts) can use to both store and retrieve information on the client side of the connection.

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## Session Transaction step



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## Session Transaction step

- Client to Server
  - POST /shopping/login HTTP/1.1 [form data]
- Server to Client
  - HTTP/1.1 200 OK
  - Set-Cookie: Customer="Nandahara "; Path="/shopping";
- Client to Server
  - POST /shopping/pickitem HTTP/1.1
  - Cookie: Customer="Nandahara ";
  - [form data]

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## Session Transaction step

- Server to Client
  - HTTP/1.1 200 OK
  - Set-Cookie: Part\_Number="PC"; Path="/shopping"
- Client to Server
  - POST /shopping/shipping HTTP/1.1 Cookie: Customer="Nandahara "; Part\_Number="PC"; [form data]
- Server to Client
  - HTTP/1.1 200 OK
  - Set-Cookie: Shipping="Fedex"; Path="/shopping"
- Client to Server
  - POST /shopping/process HTTP/1.1
  - Cookie: Customer="Nandahara "; Part\_Number="PC"; Shipping="Fedex";
  - [form data]

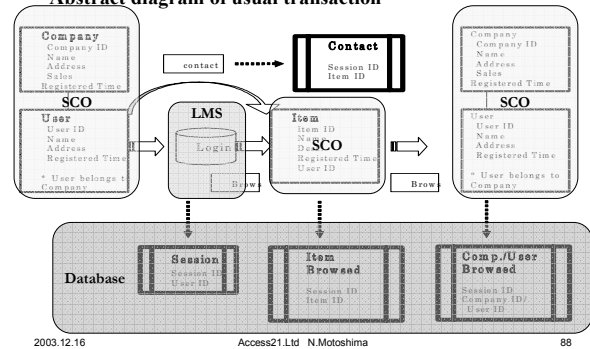
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## Session control from DB view point

### Abstract diagram of usual transaction



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## Session control from DB view point

- Item Description
  - Item ID, User ID

| Item ID | User ID | Item category | To sell | To buy | Item Title | Item description | Date            |
|---------|---------|---------------|---------|--------|------------|------------------|-----------------|
| 1017603 | 1041644 | 152           | 1       | 0      | Papyrus    | ancient paper... | 2003/1/15 11:09 |
| 1017604 | 1051317 | 1             | 0       | 1      | computer   | mobile...        | 2003/1/15 11:10 |

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## Session control from DB view point

- User Description
  - User ID, Company ID

| User ID | Company ID | status | Country | State | Last Name | Date            | Title       |
|---------|------------|--------|---------|-------|-----------|-----------------|-------------|
| 1055020 | 1054490    | 610    | 1121    | 99    | Sungwook  | 2003/1/22 14:08 | Director    |
| 1055021 | 1054491    | 610    | 9000    | 28    | Akihisa   | 2003/1/22 15:29 | manager     |
| 1055040 | 1054510    | 610    | 9000    | 14    | Hiroshi   | 2003/1/22 15:27 | GM          |
| 1055060 | 1054530    | 610    | 1240    | 99    | Naohiro   | 2003/1/23 9:56  | sales       |
| 1055080 | 1054550    | 610    | 9000    | 13    | Shigenori | 2003/1/22 15:21 | President   |
| 1055101 | 1054570    | 610    | 6110    | 02    | Lars      | 2003/1/22 15:17 | team leader |
| 1055102 | 44256      | 610    | 9000    | 13    | Noritaka  | 2003/1/22 15:13 | PM          |
| 1055140 | 52623      | 620    | 9000    | 35    | Kouta     | 2003/1/22 15:36 | sales       |

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## Session control from DB view point

- Who made login, and when ?
  - > Login session ID vs. User ID (Object)

| Login session ID | What time in    | What time out   | User ID (Object) | IP address     |
|------------------|-----------------|-----------------|------------------|----------------|
| 133738           | 2002/12/1 1:24  | 2002/12/1 1:25  | 1018270          | 62.47.92.176   |
| 133739           | 2002/12/1 2:01  | 2002/12/1 2:19  | 1028891          | 203.190.35.146 |
| 133741           | 2002/12/1 2:54  | 2002/12/1 3:09  | 1027253          | 161.184.29.198 |
| 133744           | 2002/12/1 7:17  | 2002/12/1 7:25  | 1045742          | 212.93.149.122 |
| 133746           | 2002/12/1 8:48  | 2002/12/1 8:48  | 1045141          | 202.150.0.13   |
| 133747           | 2002/12/1 8:57  | 2002/12/1 11:30 | 1032652          | 217.117.9.58   |
| 133748           | 2002/12/1 9:47  | 2002/12/1 9:48  | 68448            | 200.1.182.71   |
| 133749           | 2002/12/1 10:17 | 2002/12/1 10:37 | 68448            | 200.1.182.71   |
| 133750           | 2002/12/1 10:22 | 2002/12/1 11:52 | 1045820          | 216.139.172.18 |

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## Session control from DB view point

- To which item is each session related?
  - = Which course(SCO) is browsed
  - > Login session ID vs. Item ID

| Item ID (target) | Login session ID |
|------------------|------------------|
| 1017503          | 143884           |
| 1017503          | 143905           |
| 1017503          | 143907           |
| 1017503          | 143922           |
| 1017503          | 143971           |
| 1017503          | 143991           |
| 1017503          | 143994           |
| 1017503          | 143997           |
| 1017503          | 144001           |
| 1017503          | 144006           |

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## Session control from DB view point

- Who (Trainee) contacted to whom (Trainer)?
  - > Contact ID vs. Login session ID vs. Item ID

| Contact ID | Login session ID | Item ID (target) |
|------------|------------------|------------------|
| 164        | 890              | 1000080          |
| 450        | 3162             | 1000380          |
| 451        | 3165             | 1000381          |
| 452        | 3165             | 1000381          |
| 453        | 3165             | 1000381          |
| 454        | 3166             | 1000381          |
| 924        | 5465             | 1000330          |
| 925        | 5478             | 1000560          |
| 926        | 5478             | 1000560          |
| 927        | 5478             | 1000560          |
| 984        | 5676             | 1000332          |

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## Session control from DB view point

- Dynamic
  - > Login session ID vs. User ID (Object)
  - > Login session ID vs. Item ID (Object)
  - > Login session ID vs. User ID (Target)
  - > Login session ID vs. Item ID (Target)
  - > Contact ID vs. Login session ID vs. Item ID
- Static
  - > User ID, Company ID
  - > Item ID, User ID
  - Each ID is related to others

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## Courseware record - Learning Management -

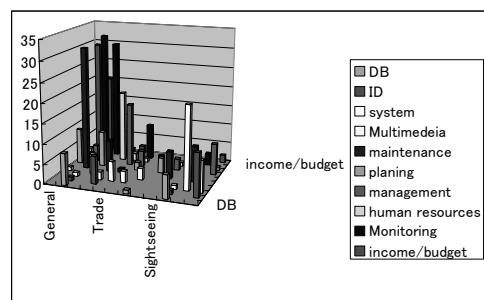
|              | DB | ID | system | Multimedia | maintenance | planning | management | human res. | Monitoring | income/bu | 合計  | ID1 |
|--------------|----|----|--------|------------|-------------|----------|------------|------------|------------|-----------|-----|-----|
| General      |    |    |        | 1          |             | 9        |            | 2          |            | 29        | 64  |     |
| Agriculture  | 8  | 1  | 1      |            | 31          | 3        | 4          | 1          | 32         | 20        | 62  |     |
| Fishery      |    |    |        | 5          |             | 9        |            |            | 30         |           | 30  |     |
| Textile      |    | 7  | 2      |            | 8           |          |            | 18         |            | 1         | 27  |     |
| Trade        |    |    | 5      |            | 1           |          | 16         | 2          |            | 2         | 20  |     |
| Culture      |    |    | 3      |            |             | 2        | 4          | 1          | 9          |           | 16  |     |
| Mechanica    | 1  |    |        | 3          |             |          |            |            | 1          |           | 6   |     |
| Electronics  |    |    |        |            |             | 4        |            |            |            |           | 4   |     |
| Sightseeing  |    |    |        |            | 7           |          | 3          | 1          |            |           | 4   |     |
| R&D          | 6  | 1  | 1      |            |             |          |            | 2          |            |           | 4   |     |
| education    |    |    | 21     |            | 9           |          |            |            | 3          |           | 3   |     |
| e-Government |    | 11 | 8      |            |             |          | 8          | 1          |            | 2         | 3   |     |
|              | 1  | 2  | 2      | 3          | 9           | 12       | 28         | 36         | 82         | 91        | 266 |     |

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## Courseware record - Learning Management -



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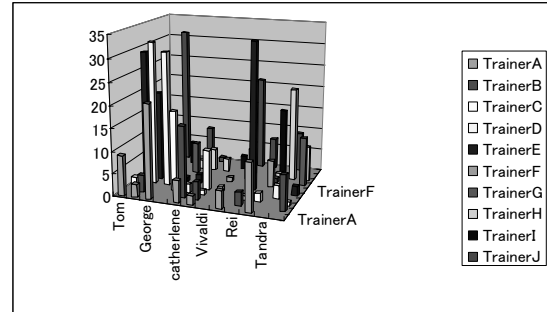
## Trainer-Trainee transaction - Learning Management -

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## Trainer-Trainee transaction - Learning Management -



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## Session Control

- **Communication session**
  - RTE API (Layer 1-7)
- **Learning session**
  - HTTP (Layer 1-5)

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## SCO – LMS (summary)

- A SCO is required to act with the SCORM RTE. The SCO must have a means to locate an LMS's API Adapter and must contain minimum API calls
  - LMSInitialize(""), LMSFinish("").
- Participation in the SCORM RTE also means that a **SCO may be launched only by an LMS**. A SCO may not call another SCO.
- This is the reason why each module act as independently, re-structural, re-usable.

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## Five topics

1. Introduction
2. Content Aggregation Model (CAM)
3. Runtime Environment Model (RTE)
- 4. Sequence and Navigation Model (SN, from 1.3)**
5. Current LMS and issues

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## 4. Sequence and Navigation Model

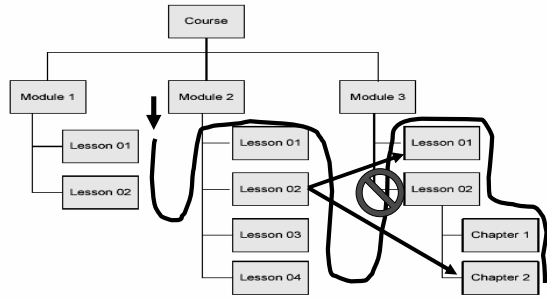
- **Sequence and Navigation**
- Sequence and Navigation Description
  - Control Mode
  - Objective Description and Sequencing Rule
  - Rollup Rule
  - Overall Sequencing Process

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## Sequence and Navigation



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## Sequence and Navigation

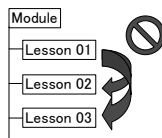
- Learner's capacity, knowledge
- Completion status
- Learning status
- Evaluation on learning objectives
- Request from learner

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## Simple Sequencing



If a learner has not complete/satisfied Lesson 01, Lesson 02 /03 are not allowed to be browsed

**Lesson 01**  
Stop Forward Traversal if not completed

**Lesson 01**  
Stop Forward Traversal if not satisfied

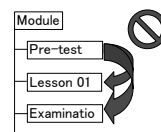
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## Simple Sequencing



**Objectives A**

If a learner has passed the Pre-test, Lesson 01 / Examination are skipped.

**Pre-test** Write Objective A  
**Lesson01** Read Objective A, Skip if satisfied  
**Examination** Read Objective A, Skip if satisfied

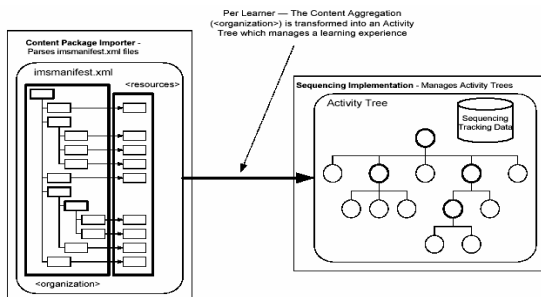
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## Sequence customization



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## 4. Sequence and Navigation Model

- Sequence and Navigation
- Sequence and Navigation Description
  - **Control Mode**
  - Objective Description and Sequencing Rule
  - Rollup Rule
  - Overall Sequencing Process

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## Sequencing Control Mode

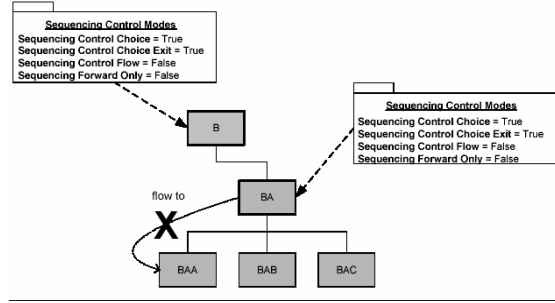
| No. | Name                                      | Description  | Value Space | Default Value |
|-----|---|--|-------------|---------------|
| 1   | Sequencing Control Choice                 | Indicates that a <i>Choice</i> navigation request is permitted to target the children of the activity.   | boolean     | True          |
| 2   | Sequencing Control Choice Exit            | Indicates that the activity is permitted to terminate if a <i>Choice</i> sequencing request is processed.  | boolean     | True          |
| 3   | Sequencing Control Flow                   | Indicates the <i>Flow Subprocess</i> may be applied to the children of the activity.   | boolean     | False         |
| 4   | Sequencing Control Forward Only           | Indicates that backward targets (in terms of activity tree traversal) are not permitted for the children of the activity.  | boolean     | False         |
| 5   | Use Current Attempt Objective Information | Indicates that the Objective Progress Information for the children of the activity will only be used in rule evaluations and rollup if that information was recorded during the current attempt on the activity. | boolean     | True          |
| 5   | Use Current Attempt Progress Information  | Indicates that the Attempt Progress Information for the children of the activity will only be used in rule evaluations and rollup if that information was recorded during the current attempt on the activity.   | boolean     | True          |

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## Choice, Flow

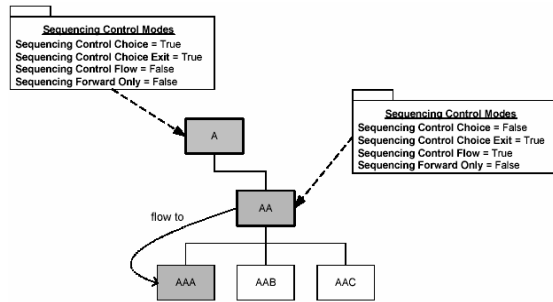


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## Choice, Flow

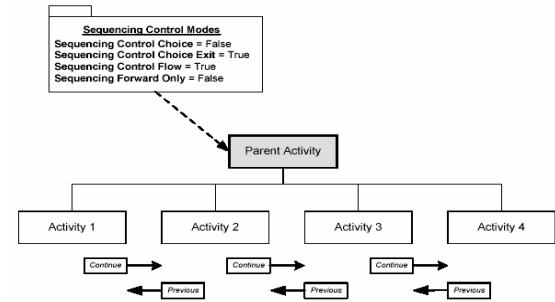


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## Forward, Continue



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## 4. Sequence and Navigation Model

- Sequence and Navigation
- Sequence and Navigation Description
  - Control Mode
  - **Objective Description and Sequencing Rule**
  - Rollup Rule
  - Overall Sequencing Process

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## Objective Description Rule

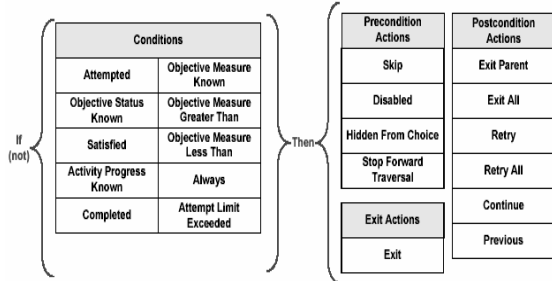
| No. | Name   | Description  | Value Space       | Default Value   |
|-----|--|--|-------------------|---|
| 1   | Objective ID                                   | The identifier of an objective associated with the activity.<br>The ID is a link to the objective's objective status record (Objective Progress Information).  | Unique Identifier | None Required   |
| 2   | Objective Satisfied by Measure                 | Indicates that the <i>Objective Minimum Satisfied Normalized Measure</i> is to be used in place of any other method to determine if the objective associated with the activity has been satisfied.   | boolean           | False   |
| 3   | Objective Minimum Satisfied Normalized Measure | Indicates the minimum satisfaction measure for the objective. If the objective's measure <u>sums or exceeds this threshold</u> , the <i>Objective Satisfied Status</i> will become Satisfied, otherwise the <i>Objective Satisfied Status</i> will become Not Satisfied. | Real [-1..1]      | 1.0<br>Precision of at least 4 significant decimal digits |
| 4   | Objective Contributes to Rollup                | Indicates that the <i>Objective Satisfied Status</i> and <i>Objective Normalized Measure</i> for the objective are used during rollup.   | boolean           | False   |

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## Sequencing rule conditions and Actions



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## Sequencing rule conditions

| Condition                      | Description  |
|--------------------------------|--|
| Satisfied                      | The Condition evaluates to True if the <i>Objective Progress Status</i> for the objective associated with the activity (indicated by the <i>Rule Condition Referenced Objective</i> ) is True and the <i>Objective Satisfied Status</i> for the objective associated with the activity (indicated by the <i>Rule Condition Referenced Objective</i> ) is True.   |
| Objective Status Known         | The Condition evaluates to True if the <i>Objective Progress Status</i> for the objective associated with the activity (indicated by <i>Rule Condition Referenced Objective</i> ) is True.   |
| Objective Measure Known        | The Condition evaluates to True if the <i>Objective Progress Status</i> for the objective associated with the activity (indicated by <i>Rule Condition Referenced Objective</i> ) is True and the <i>Objective Measure Status</i> for the objective associated with the activity (indicated by <i>Rule Condition Referenced Objective</i> ) is True.   |
| Objective Measure Greater Than | The Condition evaluates to True if the <i>Objective Measure Status</i> for the objective associated with the activity (indicated by the <i>Rule Condition Referenced Objective</i> ) is True and the <i>Objective Normalized Measure</i> for the objective associated with the activity (indicated by <i>Rule Condition Referenced Objective</i> ) is greater than the <i>Rule Condition Measure Threshold</i> . |
| Objective Measure Less Than    | The Condition evaluates to True if the <i>Objective Measure Status</i> for the objective associated with the activity (indicated by <i>Rule Condition Referenced Objective</i> ) is True and the <i>Objective Normalized Measure</i> for the objective associated with the activity (indicated by <i>Rule Condition Referenced Objective</i> ) is less than the <i>Rule Condition Measure Threshold</i> .        |
| Completed                      | The Condition evaluates to True if the <i>Attempt Progress Status</i> for the activity is True and the <i>Attempt Completion Status</i> for the activity is True.  |

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## 4. Sequence and Navigation Model

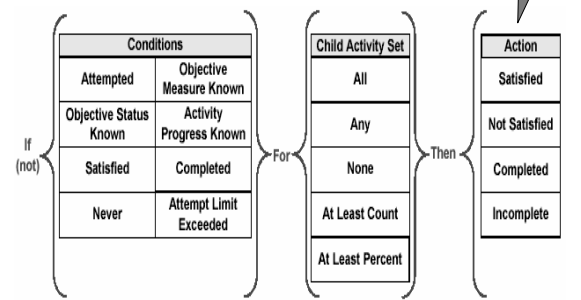
- Sequence and Navigation
- Sequence and Navigation Description
  - Control Mode
  - Objective Description and Sequencing Rule
  - **Rollup Rule**
  - Overall Sequencing Process

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## Rollup Rule



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## Code sample

- If Not Completed then Stop Forward Traversal
- If ObjectiveA Satisfied then skip
- If All (Satisfied, Completed) then exit
- If Any (
  - Objective1 Not Satisfied,
  - Objective2 Not Satisfied
 ) then Retry
- If atLeastPercent 50,
  - Any (Satisfied, Completed)
  - then Completed

Rollup

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## 4. Sequence and Navigation Model

- Sequence and Navigation
- Sequence and Navigation Description
  - Control Mode
  - Objective Description and Sequencing Rule
  - Rollup Rule
  - **Overall Sequencing Process**

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## Overall Sequencing Process

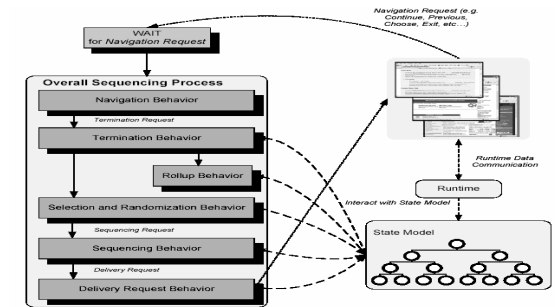
- Navigation : A navigation request is **validated** and translated into termination/sequencing requests
- Termination : Current attempt **ends** by several manner, update the status of activity
- Rollup : Affect the child activities to **cluster status**
- Selection/Randomization : **selection** activity
- Sequencing : Identify **the next activity** to deliver
- Deliver : LMS handles **delivery** of a validated activity

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## Overall Sequencing Process



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## Learner is allowed to request Navigation Request

| Navigation Request | Action   |
|--------------------|--|
| Start              | If the <i>Current Activity</i> is undefined, issue a <i>Start</i> sequencing request.  |
| Resume All         | If the <i>Current Activity</i> is undefined and the <i>Suspended Activity</i> is defined, issue a <i>Resume All</i> sequencing request.  |
| Continue           | If <i>Activity is Active</i> for the <i>Current Activity</i> is <i>True</i> , issue an <i>Exit</i> termination request.<br>Issue a <i>Continue</i> sequencing request.   |
| Previous           | If <i>Activity is Active</i> for the <i>Current Activity</i> is <i>True</i> , issue an <i>Exit</i> termination request.<br>Issue a <i>Previous</i> sequencing request.   |
| Forward            | Not specified in this version of the SCORM.  |
| Backward           | Not specified in this version of the SCORM.  |
| Choice             | If <i>Activity is Active</i> for the <i>Current Activity</i> is <i>True</i> , issue an <i>Exit</i> termination request.<br>Issue a <i>Choice</i> sequencing request. The request is accompanied by the identification of the target activity.  |
| Exit               | Issue an <i>Exit</i> termination request.<br>Issue an <i>Exit</i> sequencing request.<br>The current attempt on the <i>Current Activity</i> is terminated normally; the attempt is over. The termination of the activity was not the result of any other external navigation event (e.g., <i>Continue</i> , <i>Previous</i> , <i>Choice</i> ). |
| Exit All           | Issue an <i>Exit All</i> termination request.<br>Issue an <i>Exit</i> sequencing request.  |
| Suspend All        | Issue a <i>Suspend All</i> termination request.<br>Issue an <i>Exit</i> sequencing request.  |

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## Internal Command Sequencing Request

| Sequencing Request | Sequencing Request Subprocess            |
|--------------------|--|
| Start              | Start Sequencing Request Subprocess      |
| Resume All         | Resume All Sequencing Request Subprocess |
| Continue           | Continue Sequencing Request Subprocess   |
| Previous           | Previous Sequencing Request Subprocess   |
| Choice             | Choice Sequencing Request Subprocess     |
| Retry              | Retry Sequencing Request Subprocess      |
| Exit               | Exit Sequencing Request Subprocess       |

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## Termination Request

| Termination Request | Action   |
|---------------------|--|
| Exit                | The current attempt on the <i>Current Activity</i> is terminated normally; the attempt is over.  |
| Exit All            | The current attempts on the active activities (from the root to the <i>Current Activity</i> , inclusive) are terminated normally; the attempts are over.   |
| Suspend All         | The current attempts on the active activities (from the root to the <i>Current Activity</i> , inclusive) are suspended. The attempt on the <i>Current Activity</i> may be resumed.   |
| Abandon             | The current attempt on the <i>Current Activity</i> is terminated abnormally and the activity is not complete. The attempt may not be resumed. There is no rollback of any tracking data.                                       |
| Abandon All         | The current attempts on the active activities (from the root to the <i>Current Activity</i> , inclusive) are terminated abnormally and the activities are not complete. Attempts on any abandoned activity may not be resumed. |

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## Learn More

- **ADL (Advanced Distributed Learning)**
  - <http://www.adlnet.org/>
- **Specification documents**

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## Five topics

1. Introduction
2. Content Aggregation Model (CAM)
3. Runtime Environment Model (RTE)
4. Sequence and Navigation Model (SN, from 1.3)

## 5. Current LMS and issues

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## 5. Current LMS and issues

- Major LMSs
- SCORM Certificate system
- Some issues from interoperability view point

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## LMSs which conform to SCORM

|             |   |
|-------------|---|
| Ver.1.0.1.2 | Xcalat II (Ver.2.0)                             |
| Ver.1.2     | Knowledge Learning (Ver.3.0)                    |
| Ver.1.0.1.2 | VirtualCampus II (Ver.8.0)                      |
| Ver.1.0.1.2 | HIPLUS on Web (Ver.8)                           |
| Ver.1.2     | Cultiiva II (Ver.1.2)                           |
| Ver.1.2     | Internet Navigware (Ver.7.0)                    |
| Ver.1.2     | Campus (Ver.3)                                  |
| Ver.1.0.1.2 | Cultiiva Enterprise Powered by Docent (Ver.6.0) |
| Ver.1.2     | AcademicWare WBT (Ver.2.0)                      |
| Ver.1.2     | LearningWizard (V2.2)                           |
| Ver.1.2     | NetTutor II (V1.0)                              |
| Ver.1.2     | GET-LMS (Ver.1.0.4)                             |
| Ver.1.2     | EduWeb(+Plus)                                   |
| Ver.1.2     | IBM Lotus Learning Management System(1.0)       |

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## Leading LMSs in the world

- Blackboard
  - > <http://www.blackboard.com/>
- Aspen/Toolbook Click2Learn
  - > <http://home.click2learn.com/>
- Lotus Learning Management System IBM
  - > <http://lotus.com/lotus/offering6.nsf/wdocs/homepage>
- WebCT
  - > <http://www.webct.com/>
- Pathlore
  - > <http://www.pathlore.com/>
- Global Virtual Academy (Korea)
  - > <http://www.youngsan.co.kr/>

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## SCORM Certificate system

- Purpose
  - > Conformity information open to public
  - > To encourage to develop LMS/Contents which are interoperable
- ADL (Recently, not working)
- Certificate
  - > Testing Center
  - > "Test Suite" - test tool
  - > Certificate for LMS, Contents
  - > Certificate Logo
- SCORM Adopter
  - > Self test
  - > Listed on ADL site



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## 5. Current LMS and issues

- Major LMSs
- SCORM Certificate system
- Some issues (troubles) from interoperability view point

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## Some issues from interoperability view point

- Cannot get learner's name
- (ver 1.2) var StudentName = API.LMSGetValue("cmi.student\_name")
  - > (ver 1.3) var StudentName = API.GetValue("cmi.learner\_name")
- ⇒ Error !!
- On ver 1.2, this API is not mandatory. Some LMSs does not support this API.
- You need to add error processing into script.

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## Some issues from interoperability view point

- Cannot set value (cannot register data)
- (ver 1.2) API.LMSSetValue("cmi.core.score.raw", ResultTest01)
  - > (ver 1.3) API\_1484\_11.SetValue("cmi.score.raw", ResultTest01)
- ⇒ Not set well !!
- In some LMS, you need to make a "commit" command instantly to send data, to set the test result.
  - > "Commit" command makes refresh the data in the DB table

e.LC, 2003

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## Some issues from interoperability view point

- Cannot set value (cannot register data)
- (ver 1.2) API.LMSSetValue("cmi.core.score.raw", ResultTest01)
  - commit
  - > (ver 1.3) API\_1484\_11.SetValue("cmi.score.raw", ResultTest01)
  - > ResultTest01 is 250
- ⇒ Not set well !!
- cmi.core.score.raw should be 0 to 200
- LMS might regard 250 as 200, 0, ... or error
- cmi.score.raw has no value constraint

e.LC, 2003

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## Some issues from interoperability view point

- Cannot get value (cannot receive data)
- (ver 1.2) API.LMSGetValue("cmi.core.student\_ID")
  - > (ver 1.3) API\_1484\_11.GetValue("cmi.learner\_id")
- ⇒ Error !!
- Data model name identifies a capital letter and a small letter
- On the other hand, "cmi.core.student\_ID" does NOT identify a capital letter and a small letter

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## Some issues from interoperability view point

- Cannot record session time correctly
- cmi.total\_time, cmi.session\_time
- SCO is allowed to set cmi.session\_time several times during one session. When learner suspends or finish learning, total cmi.session\_time(s) must be added to cmi.total\_time
- ⇒ sometimes not be recorded well !!
- Standard Configuration regard cmi.total\_time, cmi.session\_time remains to be settled detail.

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## Some issues from interoperability view point

- You need detail error/exception processing
- If you want to set a certain value to cmi.core.score.min...

```

> Var IsCmiScoreChildren =
  API.LMSGetValue("cmi.core.score_children");
  if(API.LMSGetLastError() = 0) &&
  (IsCmiScoreChildren.indexOf("min") >= 0) {
    API.LMSSetValue("cmi.core.score.min", "10")
  }
  
```

Check cmi.core.score is implemented in this LMS

e.LC, 2003

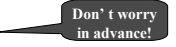

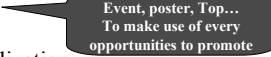
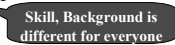

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## Cisco concept

- 1. Implement start now 
- 2. Partner with several vendors 
- 3. Shorter is better
- 4. Market is your friends 
- 5. IT is your friends, too
- 6. Plan and build for personalization 
- 7. Company impact
- 8. Communications
- 9. Virtual Product team
- 10. Business driver 

eL.C, 2003

2003.12.16

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## Reference

- ADL (Advanced Distributed Learning)
  - > <http://www.adlnet.org/>
- LMS in the world
  - > [Here](#)

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## Multimedia Database System for WBT

### 1.1 Group members

Dr. D. D. Karunaratna (Leader: Meta-data)  
 Dr. G. N. Wickkamanayake (Database design)  
 Mr. G. K.A. Dias (Database design)  
 Dr. K. P. Hewagamage (User interface design)  
 Two M Phil Students  
 Several undergraduate and MSc. Students

### 1.2 Objectives

The main objective of the research is to explore how structured multimedia databases(MMDBs) could be used to support Web-based Training, develop a framework to store multimedia objects and to develop tools to enable users to access this database efficiently with multiple modalities.

### 1.3 Activity

1. Identify a set of meta-data needed to describe the content of multimedia objects to support WBT.
2. Develop a data model to store both multimedia objects and associated metadata.
3. Develop supporting tools to manage and access the multimedia database.
4. The paper entitled “**A Tool for the Management of ebXML Resources**”, **Proceedings of IITC2003, Colombo, Sri Lanka, December 2003, pp.142-151** was presented at IITC2003.

### 1.4 Monthly wise schedule

#### Multimedia Database Systems Research Group

| Year   | 2003 | 2004 |   |   |   |   |   |   |   |   |    |    |    | 2005 |   |   |   |
|--|------|------|---|---|---|---|---|---|---|---|----|----|----|------|---|---|---|
| Month  | 12   | 1    | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1    | 2 | 3 | 4 |
| Events   |      |      |   |   |   |   |   |   |   |   |    |    |    |      |   |   |   |
| System Setup   | ■    |      |   |   |   |   |   |   |   |   |    |    |    |      |   |   |   |
| Study the available meta data standards (Ex. SCORM)            | ■    | ■    |   |   |   |   |   |   |   |   |    |    |    |      |   |   |   |
| Identify the meta-data required for the research               |      |      | ■ |   |   |   |   |   |   |   |    |    |    |      |   |   |   |
| Develop a meta-model to store meta-data and Multimedia Objects |      |      | ■ | ■ | ■ |   |   |   |   |   |    |    |    |      |   |   |   |
| MMDB Design  |      |      |   | ■ | ■ | ■ | ■ | ■ |   |   |    |    |    |      |   |   |   |
| Software Development (Server Side)                             |      |      |   |   |   |   |   | ■ | ■ | ■ |    |    |    |      |   |   |   |
| Software Development (Client Side)                             |      |      |   |   |   |   |   |   |   | ■ | ■  |    |    |      |   |   |   |
| Prototype System   |      |      |   |   |   |   |   |   |   |   | ■  | ■  | ■  | ■    | ■ | ■ | ■ |
| Publications   | ■    |      |   |   |   |   | ■ |   |   |   |    |    | ■  |      |   |   | ■ |

## 1.5 Soft goal

1. System Setup : A research lab is set-up with the required hardware. The necessary software is installed and configured.
2. Study the available meta data standards : It is essential to use meta-data to describe the content of multi-media objects. Generally, the meta-data set required to describe the semantics of data objects depends on the application. Since our goal is to explore how Multi-media databases could be used for Web-based Training, it is essential to study meta-data sets used by similar projects and the advantages and disadvantages of using these sets. The main aim of this study to identify the core meta-data set required for our research.
3. Develop a meta-model to store meta-data and Multimedia Objects : Once the required meta data set is identified, it is necessary to store both meta-data and multi-media objects in a databases. Currently relational data bases and XML databases have been used for this purposes and each of these methods has its own advantages and disadvantages. We need to evaluate these two approaches in order to determine which approach is more suitable for our research and what modifications and extensions are required for these approaches.
4. MMDB Design : The outcome of this stage would be an architecture of a data management system based on the data model identified in section 3. , to store and manage meta-data and multi-media objects in a multimedia Database. During this stage it is essential to identify the functionality required both at the user side and the server side.
5. Software Development (Server Side) : Develop software for server side requirements.
6. Software Development (Client Side) : Develop software for client side requirements
7. Prototype System : Build a prototype system by combining and integrating all software components developed up to this stage.

## 2. 3D graphics and virtual reality

### 2.1 Group members

- Dr. N.D.Kodikara (Senior Lecturer)  
Research group leader, conducting, supervising and monitoring of research
- Dr. Prasad Wimalaratne (Senior Lecturer)  
Conducting, monitoring and supervising research projects
- Mr. Pujitha Gunaratne (Lecturer, Ph.D. student)  
Conducting research projects
- Mr. C. Attanayaka (Project Assistant, M.Sc. student)  
Conducting research projects

### 2.2 Objectives

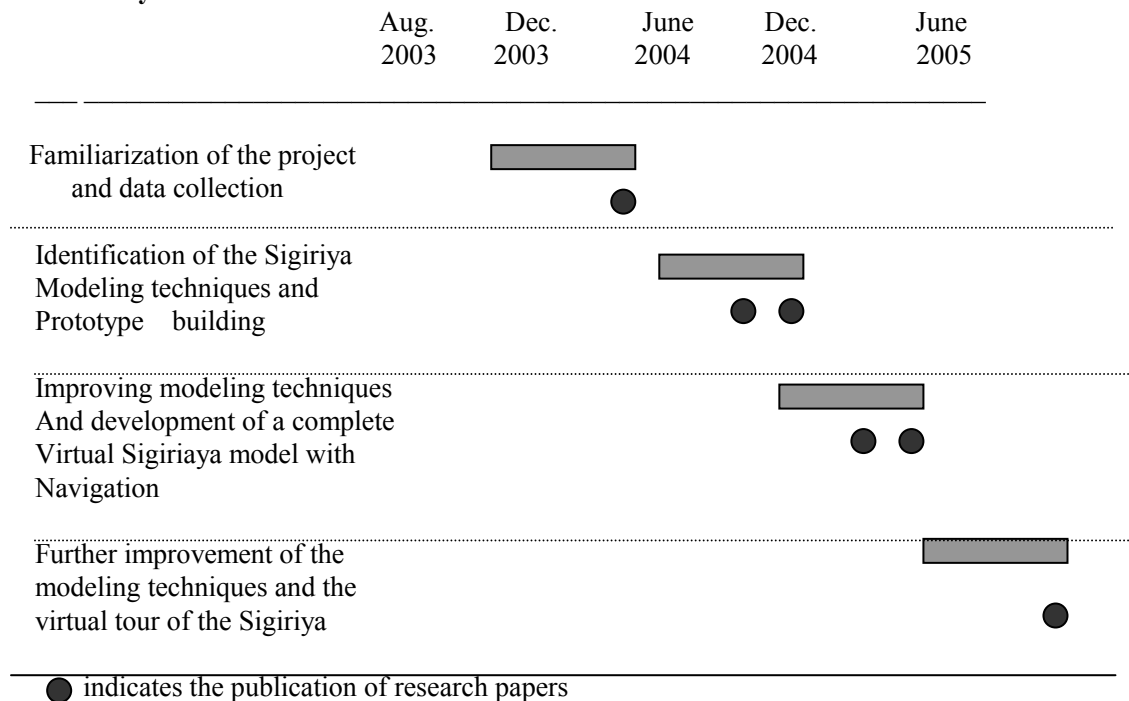
The objective of this research is to model the Sigiriya main structure using photographs taken in different view points. The coordinates of the camera positions and known land marks of the rock was obtained using a 3D GPS. Using this data the camera parameters can be identified and hence the coordinates of any unknown position (3D) on the rock can be estimated. The group has obtained large number of such data and presently working on the camera model. In addition, large number of photos of the path to Sigiriya top and its surrounding was obtained so that a virtual climb of Sigiriya can be modeled.

### 2.3 Activity

3D modeling of Sigiriya

1. Visual 3D graphics modeling of Sigiriya is continuing. The Frescoes area has been modeled. The modeling of the main structure of Sigiriya using photographs is currently in progress.
2. A paper titled **“Asymmetry in Facial Expressions : 3D Analysis using Laser Rangefinder Systems”, Proceedings of IITC2003, Colombo, Sri Lanka, December 2003, pp.152-160**, was presented at **IITC2003**. The results of this paper is based on some of the images taken using the 3D scanner received from the JICA project.
3. The graphics workstations are arrived on 31<sup>st</sup> Oct. 2003. They are now installed and will be used for the 3D graphics projects. Some of these projects are undergraduate projects.
4. A M.Phil student, one M.Sc. student and two undergraduate students are working on the research projects.
5. The 3D models of some archeological artifacts have been obtained. The techniques to reconstruct the damaged parts of the models are under study.

## 2.4 Monthly wise schedule



## 2.5 Soft goal

The broad objective of this research is to enhance the research capabilities of the UCSC by developing new techniques, which are suitable for 3D modeling applications in Sri Lanka. Staff members, research students and undergraduate students will engage in research with the assistance of the Japanese expert Prof. Kaneko. New systems using the newly developed techniques and newly acquired equipment under the JICA project will be developed and several research papers in the International Journals and conferences will be published. After the JICA project period, the research group will continue to carry out research using their acquired research knowledge and equipment received under the JICA project.

## 2.6 Other current research projects related to this field.

1. Research on facial asymmetry analysis using 3D graphics techniques and extending this research to facial recognition and expression creation. (see publication 6(2)).
2. 3D graphics modeling of archeological artifacts and techniques to reconstruct damaged artifacts.
3. Identification of optimum cutting patterns of gem stones using 3D graphics techniques.
4. Use of 3D modeling techniques in courseware development.
5. Creation of 3D visualization and interaction environment using stereo projectors, 3D mouse, Stereo glasses.

### 3. Robust Speech Recognition

#### 3.1 Research group members

Research Coordinator: Dr. Tsuneo Nitta  
Professor of Knowledge-based Information Engineering  
Graduate School of Engineering  
Toyohashi University of Technology

Research Head: Mr. S. T. Nandasara  
Advanced Digital Media Technology Center  
University of Colombo School of Computing  
Sri Lanka

Members: Dr. Ruwan Weerasinghe

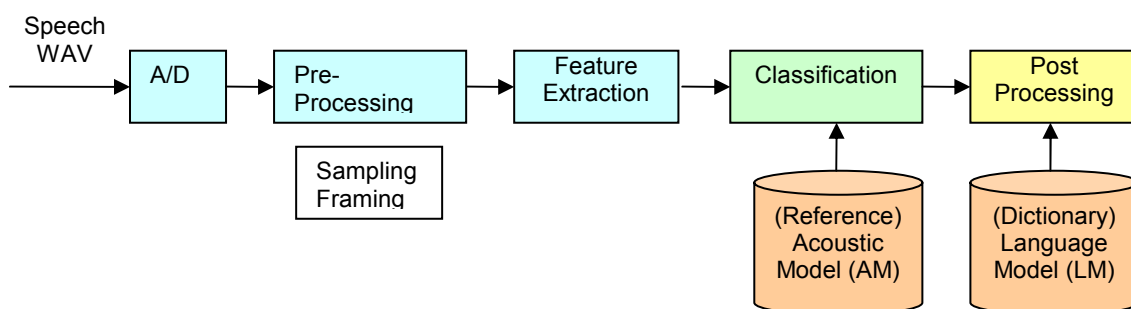
Dr Weerasinghe is expert on Natural Language Processing (NLP) and he will supervise some of the members of the group.

One or two staff members and few student will be assigning for group during January 2004.

#### 3.2 Research overview

Speech recognition is the process by which a computer (or other type of machine) identifies spoken words. Basically, it means talking to your computer, AND having it correctly recognizes what you intend. To achieve robust ASR, there are many issues including robust acoustic model (AM), language model (LM), confidence scoring strategy, etc.

The goal of this project is to develop all aspects of speech recognition in the domain of spontaneous, human-human conversational speech (as opposed to planned, read, or human-machine dialog). This includes robust feature extraction, acoustic modeling, language modeling and confidence scoring for English speech using English language corporation.

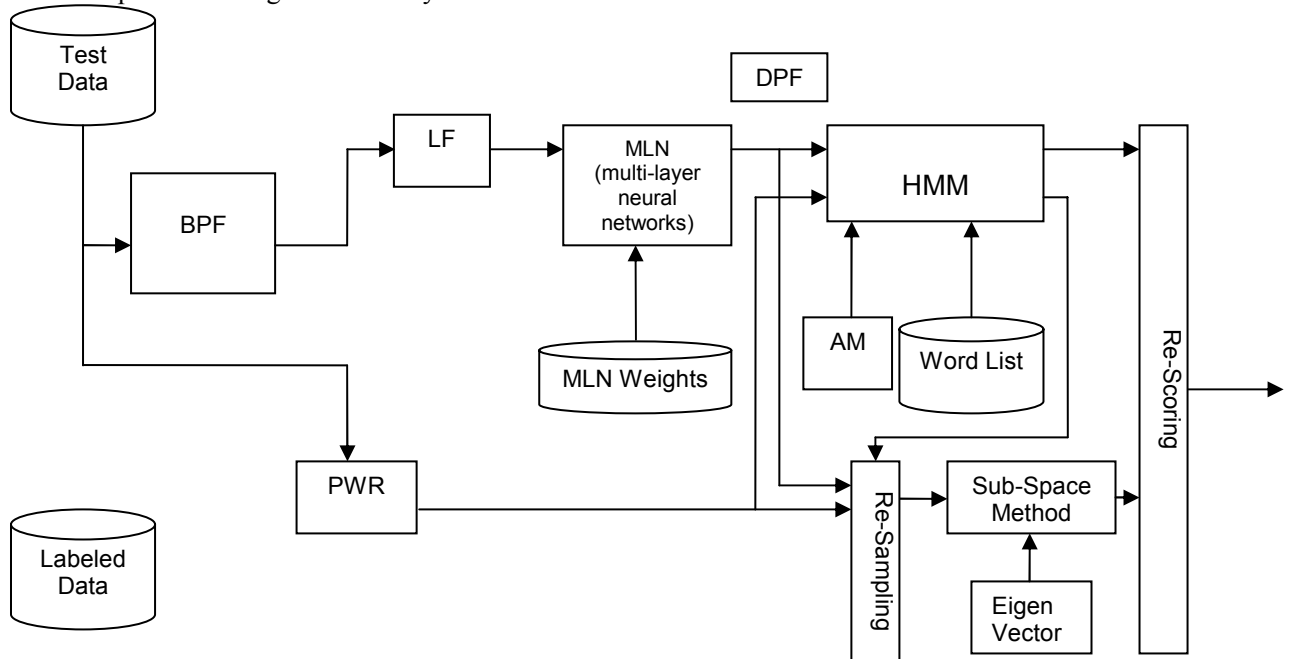


#### 3.3 Objectives

At the initial stage of the project, it will be focusing on a number of fundamental research problems that have to be solved in order to attain the ultimate goal of robust speech recognition.

1. Extracting candidate word-sequences from spontaneously spoken utterance which contains hesitations, self-repairs, etc.
2. Scoring confidence of each candidate using context of dialogue, information given by dialogue manager of a system.
3. Building of English phoneme list and identifying the language corpus are the main task of the research at initial stage.

The diagram below shows the areas and the targets of the research will be carrying during 9 months period starting from January 2004.



- BPF – Band Pass Filter (24)*
- PWR - Power*
- LF – Local Features (25)*
- DPF – Distinctive Phonetic Feature*
- MLN – Multi-Layer Neural Networks*
- HMM – Hidden Markov Model*
- AC – Acoustic Model*
- DCT – Discrete Cosine Transformation*
- DFT – Discrete Fourier Transform*
- FFT – Fast Fourier Transform*
- MFCC – Mel Frequency Cepstral Co-efficient (38)*
- SM – Subspace Method*
- Guassiam Mixture*



### 3.4 Research schedule

|   | 2003 |   |   |   |    |    | 2004 |   |   |   |   |   | 2005 |   |   |   |    |    |    |   |   |   |   |   |  |
|---|------|---|---|---|----|----|------|---|---|---|---|---|------|---|---|---|----|----|----|---|---|---|---|---|--|
|   | 6    | 7 | 8 | 9 | 10 | 11 | 12   | 1 | 2 | 3 | 4 | 5 | 6    | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 | 5 |  |
| Initial Training for Robust Speech Recognition at TUT                     | ■    |   |   |   |    |    |      |   |   |   |   |   |      |   |   |   |    |    |    |   |   |   |   |   |  |
| Further Research on HMM   |      | ■ | ■ | ■ | ■  | ■  |      |   |   |   |   |   |      |   |   |   |    |    |    |   |   |   |   |   |  |
| Further experimentation of Prof. Nitta's Lab tools                        |      |   | ■ | ■ | ■  | ■  |      |   |   |   |   |   |      |   |   |   |    |    |    |   |   |   |   |   |  |
| Setting up of Research Machine with necessary software                    |      |   |   |   |    |    | ■    | ■ |   |   |   |   |      |   |   |   |    |    |    |   |   |   |   |   |  |
| Setting up of Research Group  |      |   |   |   |    |    | ■    | ■ |   |   |   |   |      |   |   |   |    |    |    |   |   |   |   |   |  |
| Installation and Configuration of Mathematical library                    |      |   |   |   |    |    | ■    | ■ |   |   |   |   |      |   |   |   |    |    |    |   |   |   |   |   |  |
| Data Acquisition Software from USA  |      |   |   |   |    |    | ■    | ■ |   |   |   |   |      |   |   |   |    |    |    |   |   |   |   |   |  |
| Audio data identification and experimentation                             |      |   |   |   |    |    | ■    | ■ | ■ |   |   |   |      |   |   |   |    |    |    |   |   |   |   |   |  |
| Installation of Data Acquisition Instrument                               |      |   |   |   |    |    | ■    | ■ | ■ |   |   |   |      |   |   |   |    |    |    |   |   |   |   |   |  |
| Development of English language model/corpus                              |      |   |   |   |    |    | ■    | ■ | ■ |   |   |   |      |   |   |   |    |    |    |   |   |   |   |   |  |
| Testing of Feature extraction, modeling, re-sampling and re-scoring       |      |   |   |   |    |    | ■    | ■ | ■ | ■ |   |   |      |   |   |   |    |    |    |   |   |   |   |   |  |
| Result investigated by Prof. Nitta at TUT                                 |      |   |   |   |    |    | ■    | ■ | ■ | ■ |   |   |      |   |   |   |    |    |    |   |   |   |   |   |  |
| First Research Paper may be publishing                                    |      |   |   |   |    |    | ■    | ■ | ■ | ■ |   |   |      |   |   |   |    |    |    |   |   |   |   |   |  |
| Further research areas will be identify by UCSC together with Prof. Nitta |      |   |   |   |    |    | ■    | ■ | ■ | ■ |   |   |      |   |   |   |    |    |    |   |   |   |   |   |  |
| Second Research Paper may be publishing                                   |      |   |   |   |    |    | ■    | ■ | ■ | ■ |   |   |      |   |   |   |    |    |    |   |   |   |   |   |  |
| Further research will be carried out in parallel with Prof. Nitta         |      |   |   |   |    |    | ■    | ■ | ■ | ■ |   |   |      |   |   |   |    |    |    |   |   |   |   |   |  |
| Third Research Paper may be publishing                                    |      |   |   |   |    |    | ■    | ■ | ■ | ■ |   |   |      |   |   |   |    |    |    |   |   |   |   |   |  |

### 3.5 Soft goal

Two or more academic papers will be published in national/international conference or journals. Result of the research finding will be use with WBT systems. We may develop a interface for WebCT or Open Source Learning Management Systems available during period of R&D to use voice in noisy environment as a input for instruction within e-learning environment.