



# National Digital Library of India



*Development of National Digital Library of India – Towards Building a National Asset*

**WINNER *m*Billion<sup>th</sup> South Asia Award 2017:  
in Learning and Education Category  
for Android Mobile App**



## NDLI: VISION & MISSION

**NMEICT**  
National Mission on Education Through ICT

**NMEICT: National Mission on  
Education Through Information and  
Communication Technology**



Government of India  
Ministry of Human Resource  
Development





# NDL Vision

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BUILD UP

**NATIONAL DIGITAL LIBRARY OF INDIA  
AS A NATIONAL KNOWLEDGE ASSET –**

**THE KEY DRIVING FORCE FOR EDUCATION,  
RESEARCH, INNOVATION, AND  
KNOWLEDGE ECONOMY IN INDIA**



# NDL Mission

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TO CREATE A 24X7-ENABLED INTEGRATED NDL  
AS A UBIQUITOUS DIGITAL KNOWLEDGE  
SOURCE OF THE NATION – CATERING TO  
IMMERSIVE E-LEARNING FOR  
ALL LEARNERS AT ALL LEVELS IN ALL AREAS

TO INITIATE A MOVEMENT FOR INTEGRATED  
DIGITAL LEARNING ACROSS INDIA

# NDL Motto

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**INCLUSIVE**  
&  
**OPEN**





# National Digital Library of India

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## Issues, Architecture And Use Models

*Libraries are more important to the  
education system than the institutions  
such as schools, colleges and universities*  
– Rabindranath Tagore



## User-side

- Wide geographic expanse & Large population
- Huge number of students
- Large number of institutions
- Varied linguistic diversity
- Severe lack of Teachers



## Provider-side

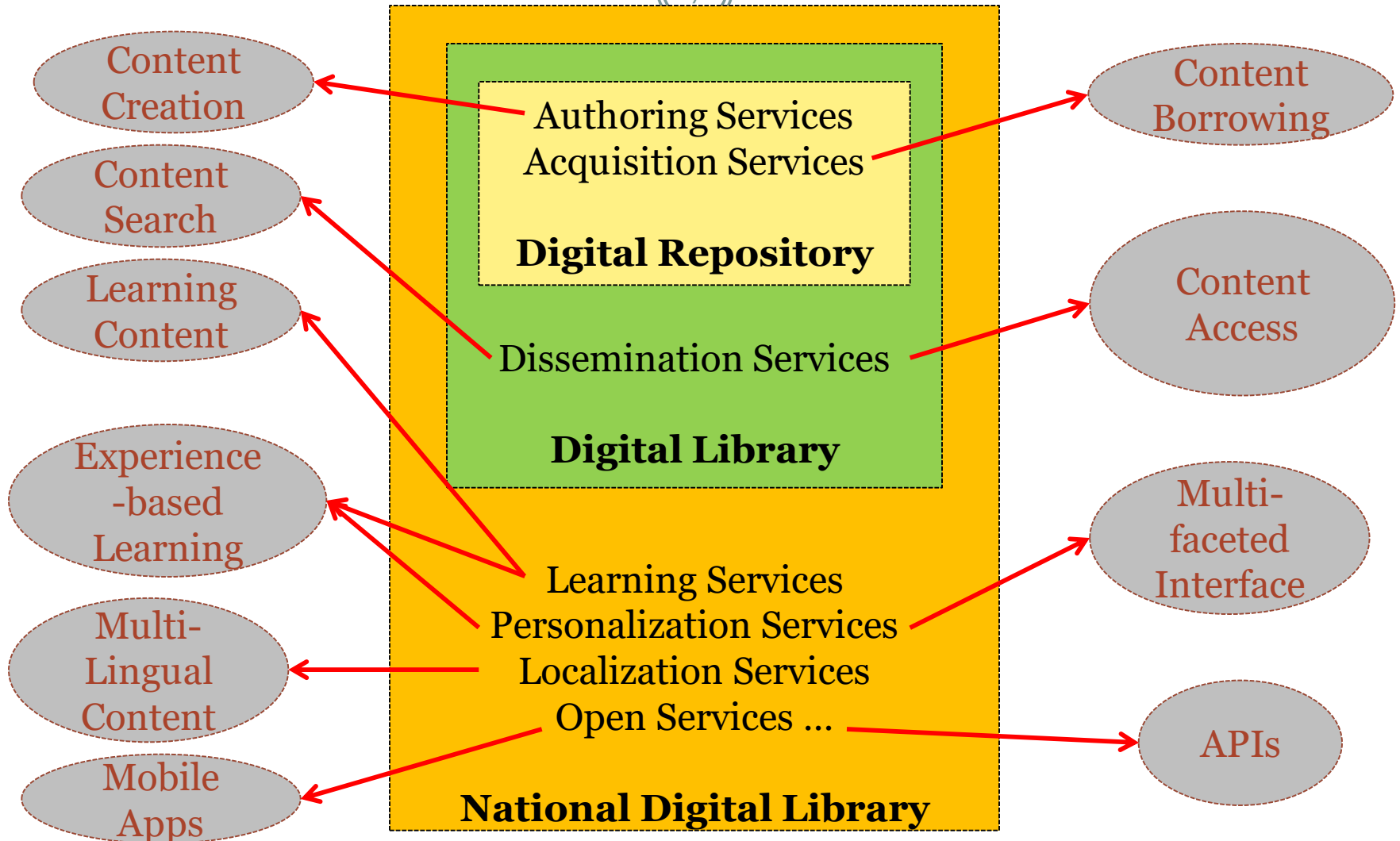
- **Wealth of digital content**
  - Books and Articles
  - ETD
  - Question Papers and Solutions
  - Video Lectures - MOOCs
  - Simulations & Animations
  - NMEICT Projects
  - Data
  - ...
- No single-window search
- Google search uses keyword – no metadata search
- Widely varied DL technology
- Lack of Interactivity, Vernacular support
- Low integration between content and learning system
- Weak ecosystem between learners and teachers



# National Digital Library: Service Architecture

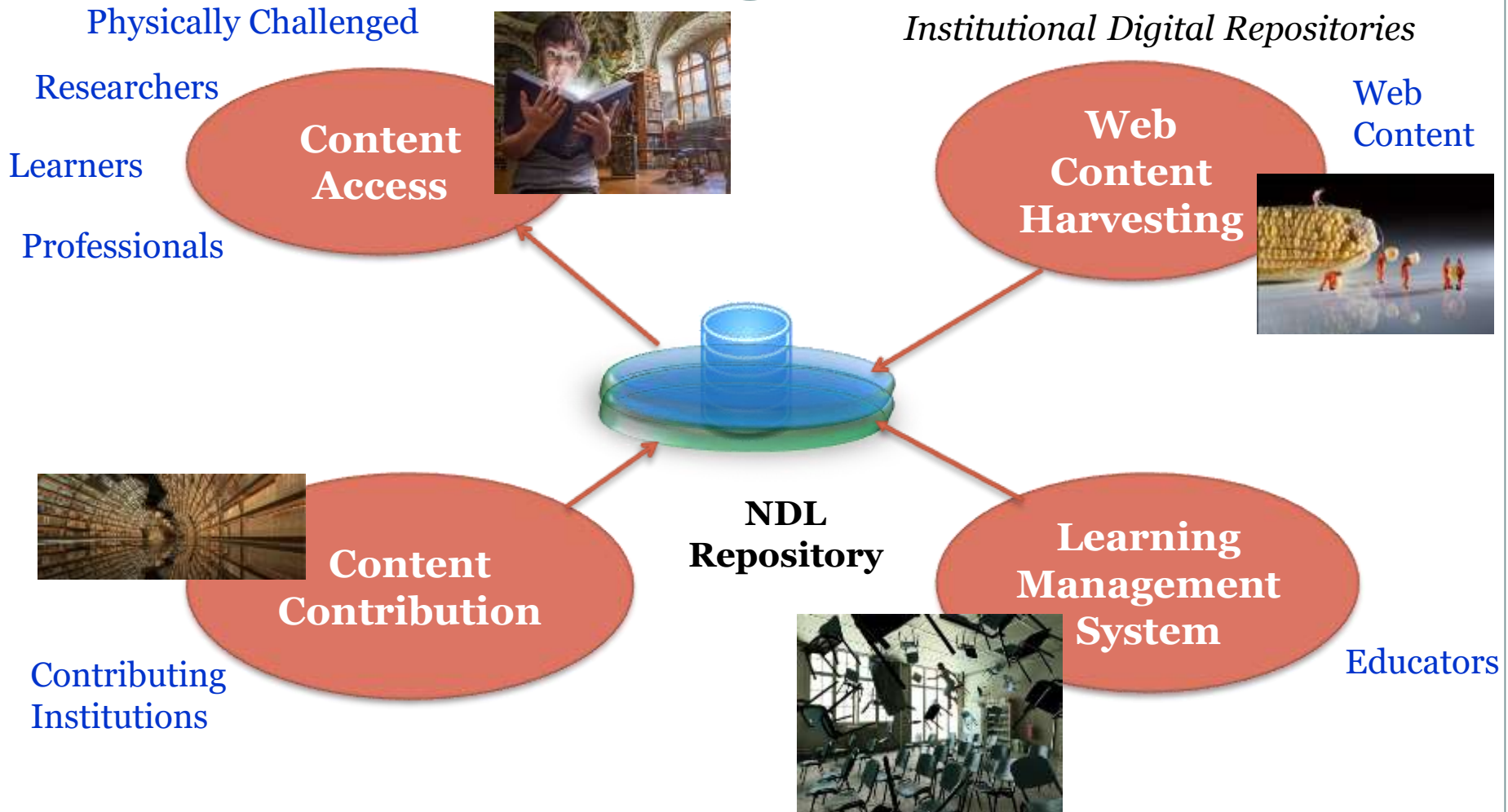


7



# Use Models

8



# Presentation Model

9

- Not a new library – an umbrella
- Collects and ingests metadata only
- Presents full-text from source view
- Provides:
  - Search
  - Browse

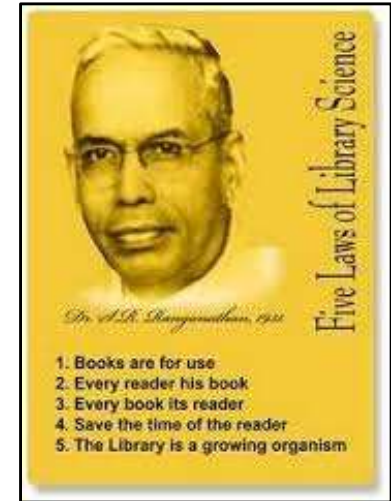


# Objective and Scope

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TARGETS  
CONTENTS,  
STAKEHOLDERS,  
CONTRIBUTORS,  
USERS,  
ARCHITECTURE, AND  
THE BIG PICTURE

*S R Ranganathan Laws*



- *Books are for use*
- *Every reader his [or her] book*
  - *Every book its reader*
  - *Save the time of the reader*
- *The library is a growing organism*



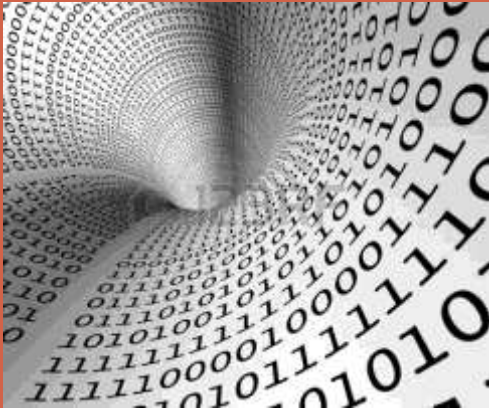
# Objectives

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- **A 24X7-enabled Infrastructure** for NDLI with single window search facility – To include h/w systems, n/w, s/w tools, applications and interoperability
- **Harvest IDRs** across institutions of the nation to provide integrated access
- Facilitate select institutes to **disseminate existing content** and **create new digital content**
- **Immersive E-learning environments** at multiple levels spanning across
  - **All academic levels** – school to life-long learning
  - **All disciplines** – Science, Arts, Engineering, Medical, Law, and
  - **All languages** – used as medium of instruction.
- **Interfaces in Indian Languages & for DA**

## Digital Contents

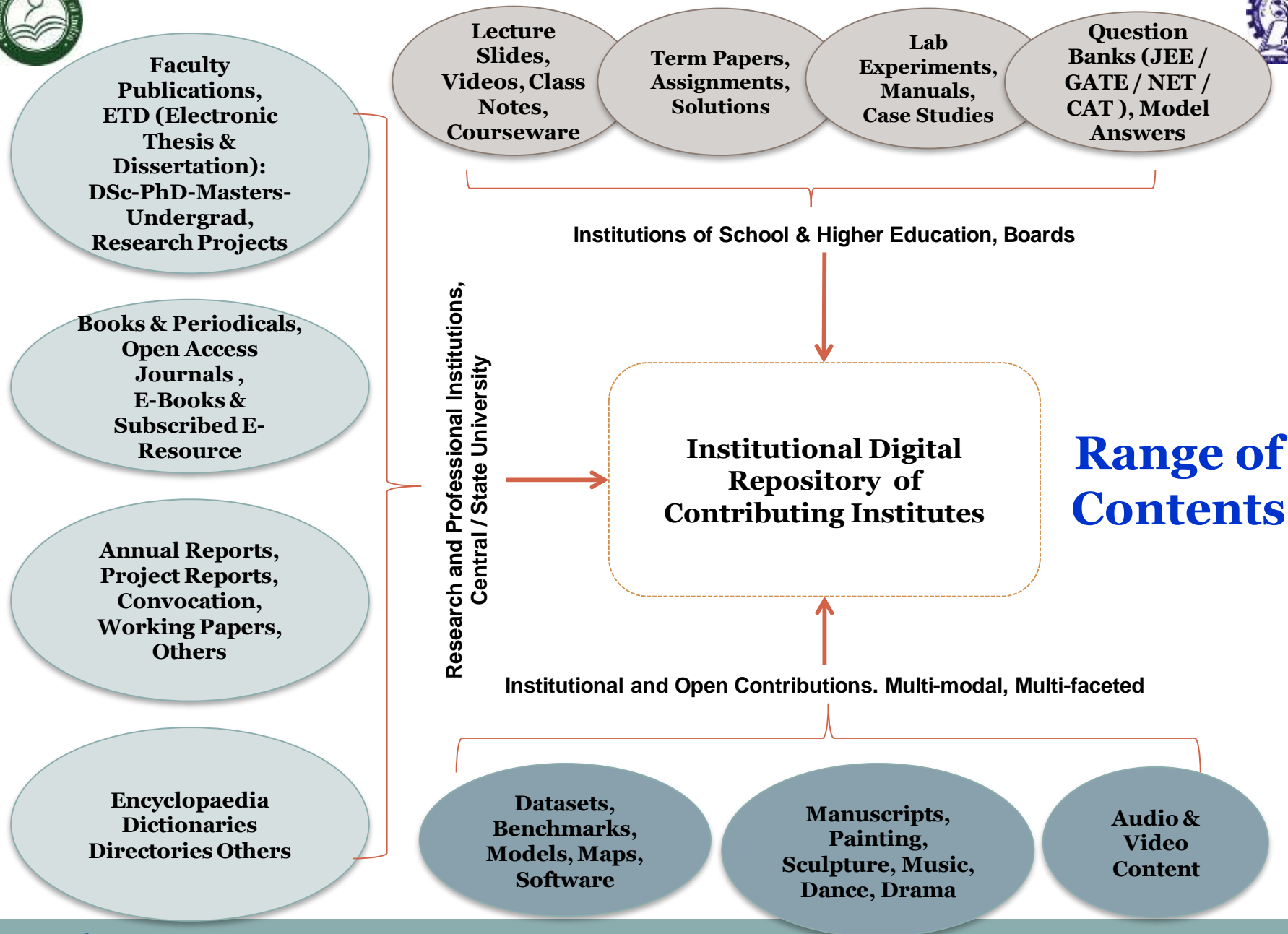
Digital, Surrogate  
Digital, Metadata  
Digital, etc.



- 7679334-abstract-image-of-tunnel-with-binary-language.jpg
- [https://www.123rf.com/profile\\_carloscastilla](https://www.123rf.com/profile_carloscastilla)
- 450 pixels X 376 pixels
- 72 dpi
- Royalty Free

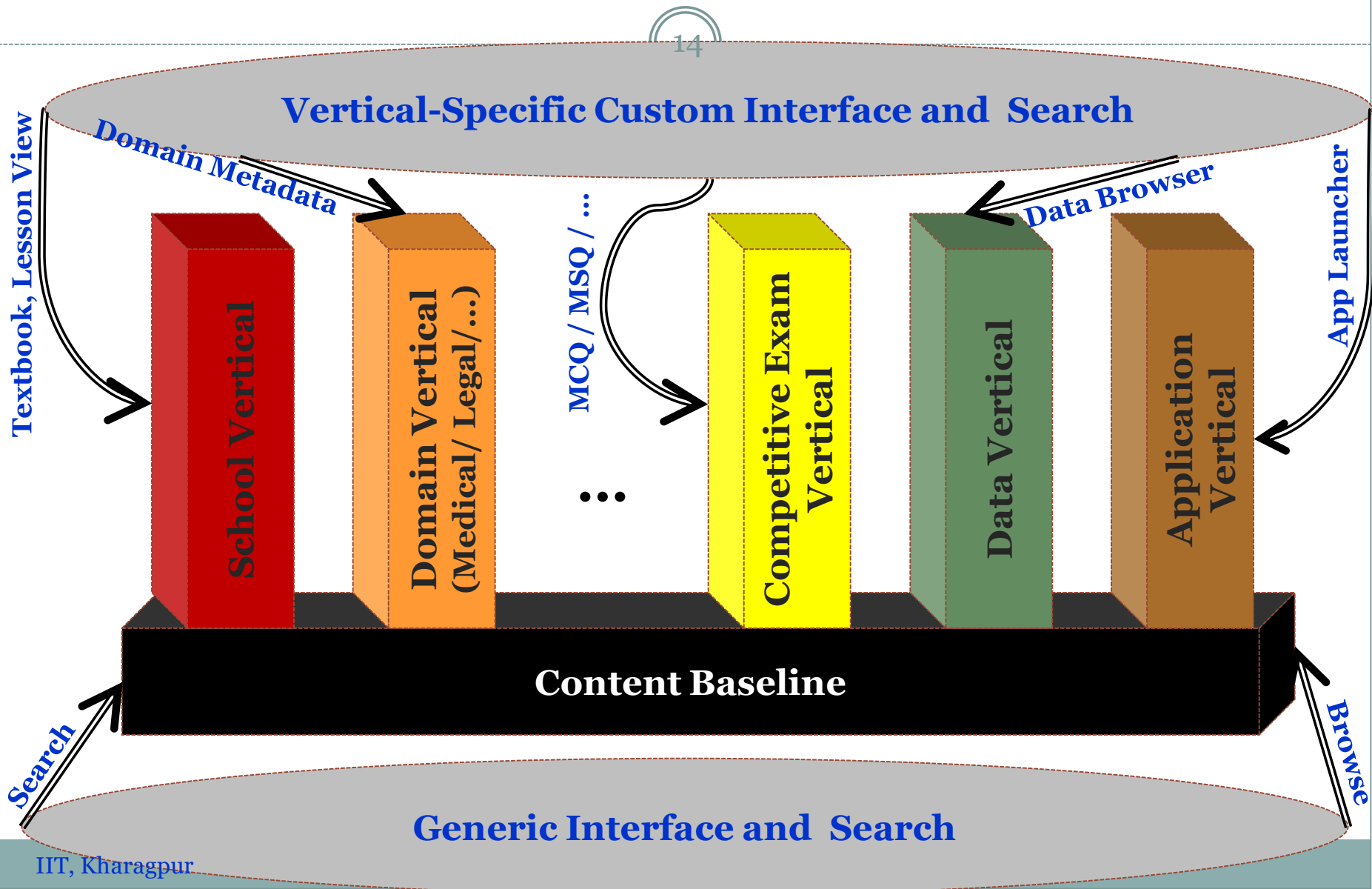
- Content at NDL
  - Born-digital object
  - Digital surrogate of a physical object
  - Digital metadata of physical object
- Metadata at NDL
  - NDL does not store contents
  - NDL only ingests metadata for Search & Browse
  - Content (Full-text) is delivered from Source

***A content is included (metadata ingested) in NDL if it is expected to have educational value***



# Content View Architecture

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# Stakeholders

## Roles and Responsibilities



Stakeholder	Roles and Responsibility
<b>Government</b>	<ol style="list-style-type: none"> <li>1. Sponsor and facilitator</li> <li>2. Content Contributor                             <ul style="list-style-type: none"> <li>• Ministries / Departments</li> <li>• R &amp; D Labs</li> </ul> </li> </ol>
<b>Institutions</b> <ul style="list-style-type: none"> <li>• Public / Private</li> <li>• Academic / R &amp; D / Educational</li> </ul>	<ol style="list-style-type: none"> <li>1. Host Institution – IIT Kharagpur</li> <li>2. Contributing Institution – Supporting IDRs</li> <li>3. Participating Institution – Providing Users &amp; Feedback</li> </ol>
<b>Public</b> <ul style="list-style-type: none"> <li>• NGOs</li> <li>• Individuals</li> </ul>	<ol style="list-style-type: none"> <li>1. Use and Feedback</li> <li>2. Metadata by Crowd Sourcing</li> <li>3. Content by Crowd Sourcing</li> </ol>
<b>Industry</b>	<ol style="list-style-type: none"> <li>1. Technology Providers</li> </ol>
<b>Publishers</b>	<ol style="list-style-type: none"> <li>1. Metadata Provider</li> <li>2. Content Provider (under various licensing schemes)</li> </ol>



## Users & Access

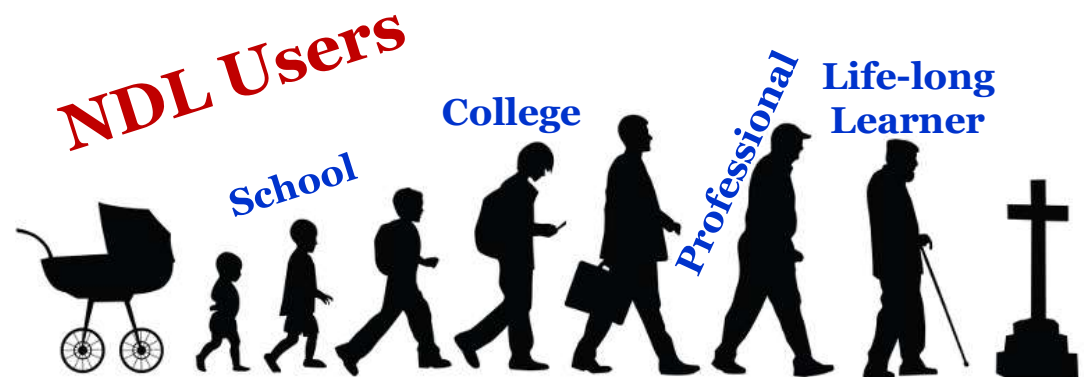
### Individual



### Institutional

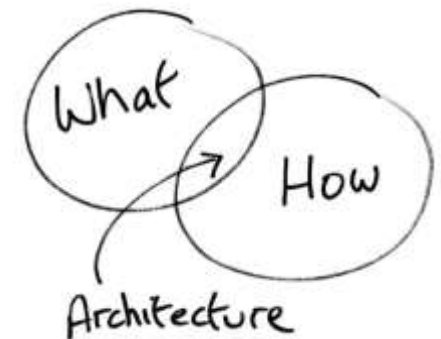


- Registration is **Open to all**
- Registration Types:
  - **Individual**
    - ✦ Registers directly
  - **Institutional**
    - ✦ By request from Institution
    - ✦ Managed by authenticated Nodal Person
    - ✦ Convenient for bulk upload of users



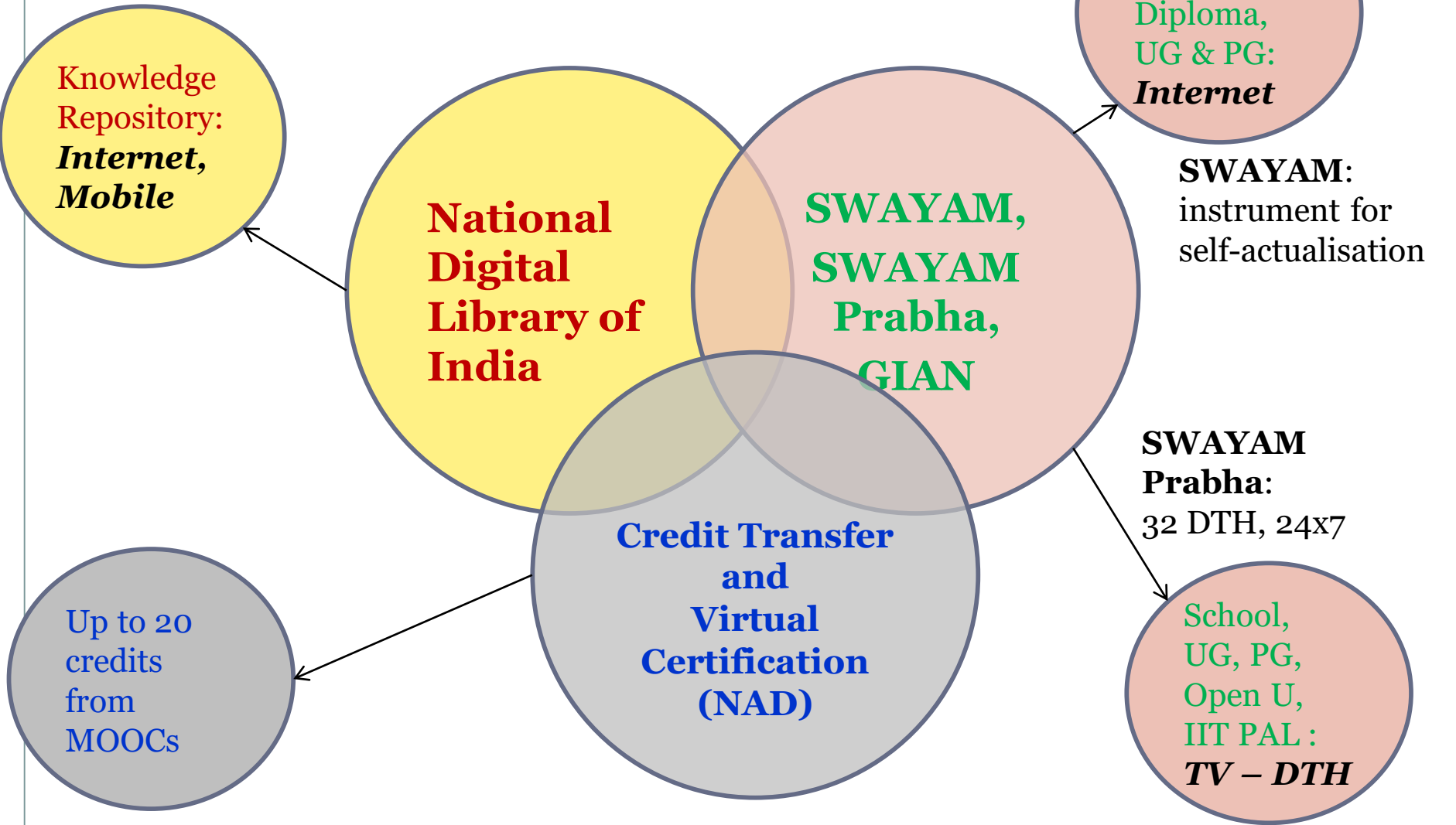
## Architecture

- Index Management
  - Ingestion of Metadata
  - Indexing of Metadata for Search
- Content Management
  - Dissemination of local contents
- Learning Management
  - Creation of Content
  - Handling learning interactions





# The Big Picture



## National Digital Initiative in Education



# NDLI Portal

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## Walkthrough

*Where the mind is without fear and the head is held high  
Where knowledge is free  
Where the world has not been broken up into fragments  
By narrow domestic walls  
Where words come out from the depth of truth  
Where tireless striving stretches its arms towards perfection  
Where the clear stream of reason has not lost its way  
Into the dreary desert sand of dead habit  
Where the mind is led forward by thee  
Into ever-widening thought and action  
Into that heaven of freedom, my Father, let my country awake.*

– Rabindranath Tagore





# Landing Page

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The screenshot shows the landing page of the National Digital Library of India. The browser address bar displays the URL <https://ndl.iitkgp.ac.in>. The page features a green header with the library's logo and name, a search bar with the text "1,544,903 items hosted in NDL", and a language dropdown set to "English". On the left, a navigation menu includes links for "About National Digital Library of India", "Learning Resource Type", "Subject Domain", "Featured Sources", and "News and Events". The main content area has a large green graphic with the text "Educational materials are available for users ranging from primary to post-graduate levels" and an illustration of a student. On the right, there is a "Member Log In" section with fields for "Email address", "Enter your password", and "Enter the displayed text" (with the value 279739). It also includes a "Remember me" checkbox, a "Log In" button, and a link for "Account Recovery". Below the login section is a "Register" button. The footer contains links for "About", "FAQ", "Disclaimer", "Sponsor", "Contact", "Institutional Registration", and "NDL Video YouTube Link", along with a "Feedback" button and a Facebook icon. The Windows taskbar at the bottom shows the time as 11:18 on 05-12-2016.



# Home Page

The screenshot shows the home page of the National Digital Library of India. At the top, there is a navigation bar with 'Browse' and 'Search' options. Below this, the main header features the library's logo, the text 'National Digital Library of India', and a search bar with the placeholder 'Enter your search key...'. To the right of the search bar, it indicates '1,544,903 items hosted in NDL' and shows the language set to 'English'. Further right, there are logos for 'SPONSORED BY MHRD' (Ministry of Human Resource Development) and 'COORDINATED BY IIT KHARAGPUR'. A central banner features a green geometric design and an illustration of a student with a graduation cap, with the text 'Educational materials are available for users ranging from primary to post-graduate levels'. On the left side, there is a vertical menu with icons and labels for 'About National Digital Library of India', 'Learning Resource Type', 'Subject Domain', 'Featured Sources', and 'News and Events'. On the right side, there is an 'Activity Area' section that says 'Hello, Anindya' and 'Welcome to National Digital Library of India', followed by a list of activities and buttons for 'Browse' and 'Search'. At the bottom, there is a footer with links for 'About', 'FAQ', 'Disclaimer', 'Sponsor', 'Contact', 'Institutional Registration', and 'NDL Video YouTube Link', along with a 'Feedback' button and a Facebook icon. The page is displayed in a browser window with the URL 'https://ndl.iitkgp.ac.in' and a Windows taskbar at the bottom showing the time as 11:22 on 05-12-2016.



# Search Result Page

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The screenshot shows a web browser window displaying the search results page for 'magnetism' on the National Digital Library of India website. The search bar at the top contains the word 'magnetism', which is circled in red with a red arrow pointing to it. The search results are displayed in a list format, with each result showing a thumbnail image, the title, source, author, and a brief abstract. The first result is 'Magnet and Compass - Magnetism, Magnetic Field, Magnets' from PHET Interactive Simulations. The second is 'Permanent Magnets And Magnetism' from Digital Library of India. The third is 'Magnets and Electromagnets - Magnetism, Magnetic Field, Electromagnets' from PHET Interactive Simulations. The fourth is 'Magnetism' from Digital Library of India. The fifth is 'Magnetism' from Digital Library of India. The sixth is 'Magnetism' from Librivox. The page also features a sidebar for refining search results and a content type filter on the right.

File Edit View History Bookmarks Tools Help

NDL: Anindya

https://ndl.itkgp.ac.in/result?q={"t":"search":"k":"magnetism","s":{"b":{"filters":{}}}}

Search

Language - Anindya -

magnetism

English

Advanced search

15,913 results found in 0.3452 secs

Refine search results

- Author
- Subject Category
- Educational Degree
- Difficulty Level
- Educational Level
- File Format
- Language
- Learning Resource Type
- Source

Content type

- All
- Text
- Audio
- Video
- Simulation
- Presentation
- Animation
- Image

**Magnet and Compass - Magnetism, Magnetic Field, Magnets**  
Source: PHET Interactive Simulations  
Classroom | Homework  
Abstract: Ever wonder how a compass worked to point you to the Arctic? Explore the interactions between a compass and bar magnet, and then add the earth and find the surprising answer! Vary the magnet's strength. [View more](#)

**Permanent Magnets And Magnetism**  
Source: Digital Library of India  
Author: Haafield, D  
Reading  
Abstract: Explore the interactions between a compass and bar magnet. Discover how you can use a battery and wire to make a magnet! Can you make it a stronger magnet? Can you make the magnetic field reverse?

**Magnets and Electromagnets - Magnetism, Magnetic Field, Electromagnets**  
Source: PHET Interactive Simulations  
Classroom | Homework  
Abstract: Explore the interactions between a compass and bar magnet. Discover how you can use a battery and wire to make a magnet! Can you make it a stronger magnet? Can you make the magnetic field reverse?

**Magnetism**  
Source: Digital Library of India  
Reading

**Magnetism**  
Source: Digital Library of India  
Author: Stoner, Edmund C.; Author | Preface By Richardson, O. W  
Reading

**Magnetism**  
Source: Librivox  
Abstract: Librivox's Short Story Collection 034: a collection of 20 short works of fiction in the public domain read by a group of Librivox members.

About FAQ Disclaimer Feedback Social Sponsor Contact

Ask me anything

11:30 05-12-2016



# Refine Search (Author) Page

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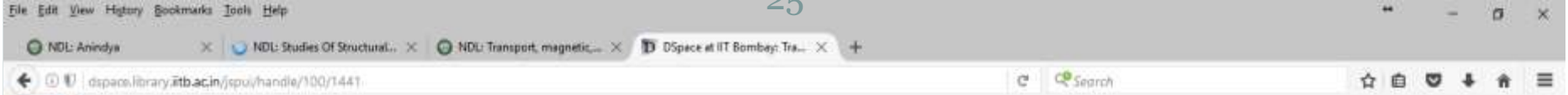
The screenshot shows the search results page for the keyword 'magnetism' on the National Digital Library of India website. The search results are filtered by author 'Gupta, L. C.', with 125 results found in 0.1498 seconds. The results list several articles, including 'Double Magnetic Transition And Anomalous Magnetoresistance In ErSUB2 SUBNiSUB3 SUBSiSUB5 SUB', 'Magnetic Properties Of RNiSUB2 SUBBSUB2 SUBC (R=Pr, Sm, Dy And Tb)', 'Valence Instability In Eu(PdSUB1-x SUBAuSUBx SUB)SUB2 SUBSiSUB2 SUB', 'Double magnetic transition and anomalous magnetoresistance in Er2Ni3Si5', 'Anomalously High TSUBm SUB For Yb-ions In A New Quaternary Borocarbide, YbNiBC', and 'Transport, magnetic, and Sn-119 Mossbauer studies on magnetically ordered valence fluctuating compound SmRuSn3'. The left sidebar shows the 'Refine search results' section with 'Author' selected and 'Gupta, L. C.' checked. The top navigation bar includes 'File', 'Edit', 'View', 'History', 'Bookmarks', 'Tools', and 'Help'. The bottom status bar shows the system clock as 11:35 on 05-12-2016.



# Full Text (Contents) Page



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**Search DSpace**  
[Search Box] Go  
Advanced Search  
Home

**Browse**  
Communities & Collections  
Issue Date  
Author  
Title  
Subject

**Sign on to:**  
Receive email updates  
My DSpace authorized users  
Edit Profile  
Help  
About DSpace

**DSpace at IIT Bombay >**  
**IITB Publications >**  
**Proceedings papers >**

**Please use this identifier to cite or link to this item:** <http://dspace.library.iitb.ac.in/jspui/handle/100/1441>

**Title:** Transport, magnetic, and Sn-119 Mossbauer studies on magnetically ordered valence fluctuating compound SmRuSn<sub>3</sub>

**Authors:** [MAZUMDAR, C](#)  
[HOSSAIN, Z](#)  
[NAGARAJAN, R](#)  
[GODART, C](#)  
[DHAR, SK](#)  
[GUPTA, LC](#)  
[PADALIA, BD](#)  
[VIJAYARAGHAVAN, R](#)

**Keywords:** cerusn3

**Issue Date:** 1996

**Publisher:** AMER INST PHYSICS

**Citation:** JOURNAL OF APPLIED PHYSICS,79(8)6349-6351

**Abstract:** SmRuSn<sub>3</sub> is a unique compound among the known Sm-based valence fluctuation (VF) systems. Its crystallographic structure has two inequivalent Sm sites and Sm ions at only one of them are in VF state while the Sm ions in the other site orders magnetically. Our (119)Mossbauer studies show a quadrupolar splitting at the Sn site, consistent with the noncubic symmetry of the Sn site. A broadening of the Mossbauer spectrum is seen due to magnetic ordering of the material. The transferred hyperfine field at Sn site at 4.2 K is small. (C) 1996 American Institute of Physics.

**URI:** <http://dx.doi.org/10.1063/1.361996>  
<http://dspace.library.iitb.ac.in/xmlui/handle/10054/14612>  
<http://hdl.handle.net/100/1441>

**ISSN:** 0021-8979

**Appears in Collections:** [Proceedings papers](#)





# Full Text (Metadata) Page

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File Edit View History Bookmarks Tools Help

NDI: Anindya

NDI: Transport, magnetic,...

ndi.iitkgp.ac.in/document/MRwIqTysyOu28XZJhvwecCTyzwrQyld79svCuTcnwdpx5ZWMVbzidZWbjrUNgn6nIFP\_SY2qzCRHkdhzWqw

Search

National Digital Library of India

Content Metadata

Tag Comment Language Anindya

Transport, magnetic, and Sn-119 Mossbauer studies on magnetically ordered valence fluctuating compound SmRuSn3

Author	Mazumdar, C. • Hossain, Z. • Nagarajan, R. • Godart, C. • Dhar, S. K. • Gupta, L. C. • Padala, B. D. • Vijayaraghavan, R.
Source	IIT Bombay
Content type	Text
Publisher	AMER INST PHYSICS
File Format	HTM / HTML
Language	English
Subject Keyword	cerusn3
Abstract	SmRuSn3 is a unique compound among the known Sm-based valence fluctuation (VF) systems. Its crystallographic structure has two inequivalent Sm sites and Sm ions at only one of them are in VF state while the Sm ions in the other site orders magnetically. Our <sup>119</sup> Mossbauer studies show a quadrupolar splitting at the Sn site, consistent with the noncubic symmetry of the Sn site. A broadening of the Mossbauer spectrum is seen due to magnetic ordering of the material. The transferred hyperfine field at Sn site at 4.2 K is small. (C) 1996 American Institute of Physics.
Education Level	UG or PG
Learning Resource Type	Article

About FAQ Disclaimer Feedback Social Sponsor Contact

Ask me anything

11:47 05-12-2016



# Full Text Page

27

File Edit View History Bookmarks Tools Help


NDL: Anindya x NDL: Transport, magnetic, ... x +

ndi.iiitkgp.ac.in/document/MRw1qtyayOu28XZJHwveoCTycwrDyld79svCuTcrwdpxSZWMVbldZWbYrUjNgn6nlP-...SY2qrCRHkdhzWqw

Search

Tag Comment Language - Anindya -

Page 1 of 4 Automatic Zoom



**Transport, magnetic, and 119Sn Mössbauer studies on magnetically ordered valence fluctuating compound SmRuSn3**

Chandan Mazumdar, Z. Hossain, R. Nagarajan, C. Godart, S. K. Dhar et al.

Citation: *J. Appl. Phys.* **79**, 6349 (1996); doi: 10.1063/1.361996  
View online: <http://dx.doi.org/10.1063/1.361996>  
View Table of Contents: <http://jap.aip.org/resource/1/JAPIAU/v79/i8>  
Published by the American Institute of Physics.

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**Related Articles**

Valence fluctuation and electron-phonon coupling in La<sub>68-x</sub>Ce<sub>x</sub>Al<sub>10</sub>Cu<sub>20</sub>Co<sub>2</sub> (x = 0, 34, and 68) metallic glasses  
*J. Appl. Phys.* **108**, 033525 (2010)

Intermediate valency of Eu in a cubic intermetallic compound Ce<sub>0.5</sub>Eu<sub>0.5</sub>Pd<sub>3</sub>  
*Appl. Phys. Lett.* **94**, 182503 (2009)

Interface and Mn valence effects in ferromagnetic insulating multilayers based on Mn and tin oxide  
*J. Appl. Phys.* **103**, 07D129 (2008)

Charge states of strongly correlated 3d oxides: from typical insulator to unconventional electron-hole Bose liquid  
*Low Temp. Phys.* **33**, 234 (2007)

The effect of mixed Mn valences on Li migration in LiMn<sub>2</sub>O<sub>4</sub> spinel: A molecular dynamics study  
*Appl. Phys. Lett.* **84**, 529 (2004)

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**Additional information on J. Appl. Phys.**

About FAQ Disclaimer Feedback Social Sponsor Contact

Ask me anything

11:57 05-12-2016



# Refine Search (Educational Level) Page



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The screenshot shows a web browser window displaying the search results for 'magnetism' on the National Digital Library of India website. The search results are filtered by educational level, with 'Class XI to XII' selected. The results list includes 'Spoke Magnet', 'Magnetism and matter', 'Moving charges and magnetism', and 'Physics: question paper'. A red circle highlights the 'Class XI to XII' filter option in the left sidebar, with a red arrow pointing to it.

File Edit View History Bookmarks Tools Help

NDL: Anindya

https://ndl.itkgp.ac.in/result?q={\"search\":\"magnetism\",\"educational\_level\":\"highSchool\",\"filters\":[]}

Search

Language - Anindya -

magnetism

43 results found in 0.2153 secs  
Class XI to XII

Refine search results

- Author
- Subject Category
- Difficulty Level
- Educational Level 1

Q Enter your search key...

- UG or PG 12,605
- Career develop... 141
- Class XI to XII 49
- Class IX to X 15
- Class V to VIII 0

File Format

Language

Learning Resource Type

Source

Content type

- All
- Text
- Animation

**Project OSCAR** Spoke Magnet  
Source: Project OSCAR  
Author: Sahasrabudhe, Sameer  
Demonstration | Self Learning | Class IX to X | Class XI to XII

**Magnetism and matter**  
Source: NCERT  
Reading | Class XI to XII

**Magnetism and matter**  
Source: NCERT  
Assessment | Class XI to XII

**Moving charges and magnetism**  
Source: NCERT  
Reading | Class XI to XII

**Moving charges and magnetism**  
Source: NCERT  
Assessment | Class XI to XII

**Physics: question paper**  
Source: NCERT  
Assessment | Class XI to XII

About FAQ Disclaimer Feedback Social Sponsor Contact

Ask me anything

12:00 05-12-2016



# Full Text (NCERT) Page



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File Edit View History Bookmarks Tools Help

NDL: Anindya NDL: Magnetism and mat...

ndl.iitkgp.ac.in/document/ktDhUnHq-a\_r3VwSwT-SXhIAJ4GkgnfXO2EMq1\_sO7IT31105I9mrwYyRphNw9cz5cyIKSDcDFATj908FmQ

National Digital Library of India

Content Metadata

Page 1 of 11 Automatic Zoom

Chapter Five  
**MAGNETISM AND MATTER**

Electric charges and fields  
Electrostatic potential and capacitance  
Current electricity  
Moving charges and magnetism  
**Magnetism and matter**  
Electromagnetic induction  
Alternating current  
Electromagnetic waves  
Answers:  
Glossary

About FAQ Disclaimer Feedback Social Sponsor Contact

Ask me anything

12:01 05-12-2016



# Search Filter Page (Video)



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File Edit View History Bookmarks Tools Help

NDL: Anindya

https://ndl.itkgp.ac.in/result?q=[{"type":"video"}]

National Digital Library of India

magnetism

176 results found in 0.1509 secs

English

Advanced search

Refine search results

- Author
- Subject Category
- Educational Level
- File Format
- Language
- Learning Resource Type
- Source

Content type

- Video

Magnetic Resonance

Source: NPTEL  
Author: Rangarajan, G.  
Lecture | UG or PG  
ENG

Magnetic Fields

Source: NPTEL  
Author: Vasudevan, Krishna  
Lecture | UG or PG  
ENG

Magnetic Circuit

Source: NPTEL  
Author: Vasudevan, Krishna  
Lecture | UG or PG  
ENG

Magnetic permeability

Source: Khan Academy  
Self Learning  
ENG

Abstract: Let's find out more about this invisible force which guides the compass. How strong is it? What shape is it?

Floating magnet

Source: Khan Academy  
Self Learning  
ENG

Abstract: The discovery of magnetism. What can we do with this invisible force?

Solving for Magnetic Field of a magnet in presence of Magnetic Materials

Source: NPTEL  
Author: Harbola, Manoj K  
Lecture | UG or PG

About FAQ Disclaimer Feedback Social Sponsor Contact

Ask me anything

12:02 05-12-2016



# Browse (by Type) Page

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The screenshot displays the 'Browse (by Type)' page on the National Digital Library of India website. The 'Audio' tab is highlighted with a red circle and a red arrow. The search results are as follows:

Title	Source	Author	Level	Language
Dr. P. Govindasamy, syndicate member felicitating vice chancellor Dr.K.Meena.	Bharathidasan University	Govindasamy, P.	UG or PG	TAM
Dr. P. M. Mansure, syndicate member felicitating vice chancellor Dr.K.Meena.	Bharathidasan University	Mansure, P. M.	UG or PG	TAM
Anna Birthday function	Bharathidasan University	Meena, K.	UG or PG	TAM
Logic	Librivox	Stock, George William Joseph		ENG
The Ontario Readers Third Book	Librivox			ENG
Acknowledgements	Librivox			

The footer contains links for About, FAQ, Disclaimer, Feedback, Social, Sponsor, and Contact. The system tray shows the time as 12:26 on 05-12-2016.



# Browse (by Subject) Page

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File Edit View History Bookmarks Tools Help

NDL: Anindya

https://ndl.itkgp.ac.in/result?q=[{"\*": "DDC": "511%3A%3AGeneral principles of mathematics"}]

Natural sciences & mathematics Mathematics General principles of mathematics

282 results found in 0.0516 secs

Refine browse results:

- Author
- Difficulty Level
- Educational Level
- File Format
- Language
- Learning Resource Type
- Source
- Content Type

**Fractions and Decimals**  
Source: SCERT Andhra Pradesh  
Classroom | Reading | Class V to VIII

**Smart Tables**  
Source: SCERT Andhra Pradesh  
Classroom | Reading | Class I to IV

**Mathematics (code 81- E) question paper April 2013**  
Source: Karnataka Secondary Education Examination Board  
Classroom | Reading | Problem Solving | Class IX to X

**Lecture 1: Introduction and Proofs**  
Source: MIT OpenCourseWare  
Self Learning | UG or PG  
**Abstract:** Introduction to mathematical proofs using axioms and propositions. Covers basics of truth tables and implications, as well as some famous hypotheses and conjectures.

**Lecture 11: Relations, Partial Orders, and Scheduling**  
Source: MIT OpenCourseWare  
Self Learning | UG or PG  
**Abstract:** Covers definitions and examples of basic relations, equivalence classes, Hasse diagrams and topological sorts, as well as other topics.

**Lecture 13: Sums and Asymptotics**  
Source: MIT OpenCourseWare  
Self Learning | UG or PG  
**Abstract:** Analysis of sums, formulation of asymptotic bounds using various techniques, and introduction to asymptotic notation.

About FAQ Disclaimer Feedback Social Sponsor Contact

Ask me anything

12:30 05-12-2016



# Browse (by Source) Page

33

The screenshot shows the National Digital Library of India website. The top navigation bar includes 'Browse', 'Search', 'Language', and 'Anindya'. The 'Browse' menu is highlighted with a red circle, and a red arrow points to it from the right. Below the navigation bar, there are several search results for 'Krishikosh' with various agricultural topics. The results are listed in a table format with columns for 'Thumbnail', 'Title', and 'Source'. The source for all results is 'Krishikosh - Indian National Agricultural Research System'. The page also shows a search bar, a search button, and a search results count of 49,654 results found in 0.0028 secs.

Thumbnail	Title	Source
thumbnail not available	Minimal Descriptors Agri-Horticultural Crops: Fruit Crops	Krishikosh - Indian National Agricultural Research System
thumbnail not available	Commercialization Of Spices Medical And Aromatic Crops 1 - 2Noov	Krishikosh - Indian National Agricultural Research System
thumbnail not available	National Symposium On Current Trends In Onion Garlic,Chillies,And Seed Spices Production Marketing Utilization	Krishikosh - Indian National Agricultural Research System
thumbnail not available	Crops Product Diversification 8-10 November	Krishikosh - Indian National Agricultural Research System
thumbnail not available	Threats And Solutions To Spices And Aromatic Crops Industry	Krishikosh - Indian National Agricultural Research System
thumbnail not available	Harnessing The Potential Of North Eastern State For Spices Production Through	Krishikosh - Indian National Agricultural Research System



# Browse by (Learning Resource Type) Page



34

File Edit View History Bookmarks Tools Help

NDL: Anindya

https://ndl.itkgp.ac.in/result?q=[{"learningResourceType":"k":"a","b":{"browse":"learningResourceType","filters":{"learningResourceType="article"}}}] Search

National Digital Library of India

Browse Search Language Anindya

Book **Article** Theses Question Paper Video Lecture Audio Lecture Article

280,880 results found in 0.0774 secs

Refine browse results

- Author
- Subject Category
- Educational Degree
- Difficulty Level
- Educational Level
- File Format
- Language
- Source
- Content Type

Indian Statistical Institute

**On resolvable and affine resolvable variance - balanced designs**

Source: ISI Kolkata  
Author: Mukherjee, Rahul | Kageyama, Sanpei  
UG or PG  
ENG

Indian Statistical Institute

**Tenurial contracts in a peasant movement belt: field data on naxal bar, Kharibari and Phansidewa regions**

Source: ISI Kolkata  
Author: Chattopadhyay, Manabendu | Ghosh, Sumit Kumar  
UG or PG  
ENG

Indian Statistical Institute

**Characterizations multivariate normality. I through independence of some statistics**

Source: ISI Kolkata  
Author: Khatri, C. G. | Rao, C. Radhakrishna  
UG or PG  
ENG

Indian Statistical Institute

**Demography and demographical genetics of two isolated mountain villages of Northern Sikkim, Eastern Himalaya**

Source: ISI Kolkata  
Author: Das, Sawpan Kumar | Majumder, Partha P  
UG or PG  
ENG

Indian Statistical Institute

**An IPPS sampling scheme using Lahiris method of selection**

About FAQ Disclaimer Feedback Social Sponsor Contact

Ask me anything

13:09 05-12-2016



# Indian Language (Hindi) Interface Page

35

File Edit View History Bookmarks Tools Help

NDL: Anindya

https://ndl.itkgp.ac.in/result?q={\"search\": \"महात्मा गांधी\", \"b\": \"Hindi\"}

National Digital Library of India

महात्मा गांधी

22 परिणाम प्राप्त हुए हैं - 2956 सेकण्ड्स में

हिन्दी

आप - Anindya

खोज परिणामों को परिष्कृत/रिफाइन करें

- रेखांक
- विषय
- बैज्ञानिक शिष्टी
- कठिनाई स्तर
- बैज्ञानिक स्तर
- फ़ाइल फॉर्मेट, प्रारूप
- भाषा
- बैज्ञानिक संसाधन के प्रकार
- स्रोत संगठन

महात्मा गांधी

स्रोत: Karnataka Secondary Education Examination Board  
Classroom | Reading | कक्षा (X - कक्षा) X

महात्मा गांधी और स्व-निर्भरता

स्रोत: NCERT  
Reading | कक्षा (X) - कक्षा (X)

महात्मा गांधी और राष्ट्रीय आंदोलन

स्रोत: NCERT  
Reading | कक्षा (X) - कक्षा (X)

नौकर

स्रोत: NCERT  
Reading | कक्षा (V - कक्षा) VIII

स्वतंत्रता की ओर

स्रोत: NCERT  
Reading | कक्षा (I - कक्षा) IV

महात्मा गांधी यांचे गुरु नामदार गोपाळ कृष्ण गोखले जीवन - परिचय

स्रोत: Gokhale Institute of Politics and Economics  
लेखक: Tope, Timbak, Kharasro  
Reading | कक्षा या सामग्री

सामग्री प्रकार

अपने सुझाव भेजें

12:46  
05-12-2016

# NDL Mobile App

36

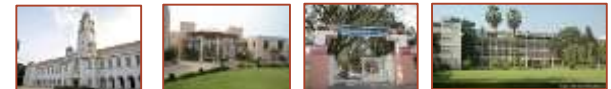


**Available on**  
**Android**  
**And**  
**iOS**

# Institutional Roles and Responsibilities

37

TERMS OF REFERENCE TO CONTRIBUTE TO NDL



The *worth of a librarian* should be gauged by his power of attracting and looking after such circles by acting as the intermediary of an intimacy of relationship between *reader and the library*. – *Rabindranath Tagore*



# Roles and Responsibilities



38

## Host Institution

- **IDR**
  - Support for Setting up IDR
  - Installation CD
  - Manual
  - Training
  - IDR Service, if needed
- **Metadata**
  - NDL Metadata Standard
  - Creation, Curation Workflow
- **User**
  - Institutional Registration for Nodal Person
  - Bulk Addition of Users
- **Ongoing Support**
  - Over email, phone
  - Hands-on at NDL, if needed

## Contributing or Participating Institution

- **IDR (CI only)**
  - Setup IDR in Institutional LAN
  - Register with OPENDOAR / ROADMAP
  - OAI-PMH compliance for harvesting
  - OAI-ORE compliance for full-text access
  - Allow external access & Update regularly
- **Content (CI only)**
  - Add Content
  - Encourage faculty, students, staff to contribute
  - Create and Curate Metadata
- **User**
  - Register as an Institution
  - Add users in bulk or send to NDL
- **Promote**
  - Organize Workshop
  - Identify and Integrate Source



# Technology of NDL

39

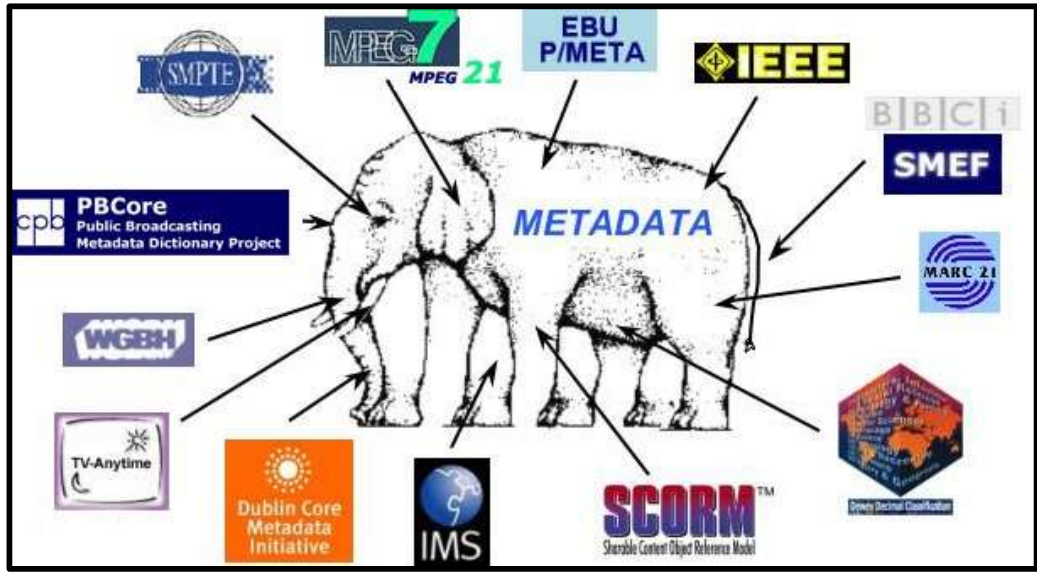
**METADATA ENGINEERING**

**USER INTERFACE & EXPERIENCE TRACKING**





# Metadata Standard



Source: <http://courseweb.ischool.illinois.edu/~butler9/LIS501b/current.html>



# Metadata Standard

42

- **Metadata**

- Is primarily **textual information** relating to Content
- Includes information that enables users to **identify, discover, search, browse, interpret, or manage** Content
- Includes **hyperlinks** that direct users to Content on the Source
- May include an **expressive description** of the Content

- **Metadata Standard**

- Defines **common understanding of the semantics** of the data
- Ensures **correct and proper use** and interpretation of the data
- Defined through a **set of fields, vocabs (optional), and instructions** for fill-up



# NDL Metadata Design Challenges

43

- **Wide** category of resources
  - Generic metadata or domain specific?
- **Openness** of repository
  - Closed metadata standard may fail to describe a new resource
- **Scale** is enormous
  - Manual annotation is infeasible
  - Automatic annotation guided by crowd sourcing?





# Metadata Requirements Specs

44

- **To describe any digital resource**
  - Generic content metadata
    - ✦ Contributor, Description, Language, Format etc.
- **To describe domain specific resources**
  - Educational content metadata
    - ✦ Educational level, ToC, Type of learning material etc.
  - Thesis metadata
    - ✦ Institution, advisor, degree, researcher



# NDL Metadata Standard

45

- NDL Metadata Standard v 1.0 is an **Open Virtual Standard**
  - URL:  
<http://www.ndlproject.iitkgp.ac.in/ndl/header.php?mname=Metadata%20Schema>
- Schema is categorized into three profiles:
  - **Generic Metadata:**
    - ✦ Describes general attributes of the contents
    - ✦ Adopted from **Dublin Core Metadata Standard**
  - **Educational Metadata:**
    - ✦ Describes the educational attributes of the resources and helps in enumerating properties of the contents relevant to teaching-learning process
    - ✦ Adopted from **Learning Resource Metadata Initiative (LRMI)**
  - **Thesis Metadata:**
    - ✦ Describes dissertation or thesis related metadata fields
    - ✦ Adopted from **Shodhganga Thesis Metadata Standard**
  - More profiles may be added in future
- Uses the **namespace of Dublin Core (dc.)**

# Metadata Envelop

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$$\frac{M\Sigma}{\delta(\alpha)} ta$$

# ***Metadata Acquisition***



# Acquisition Scenarios

48

## Locate Content

- Harvest Institutional IDRs
- Crawl Websites
- In Bulk – from Publishers
- Donated by Source
- Source-supported API
- ...

## Acquire Metadata

- Creation
  - Manual
  - Automated
- Translation
  - Format
  - Standard / Schema
- Curation
  - Manual
  - Assisted
- Ingestion



# Challenges in Metadata Acquisition

49

- Different sources follow different norm in annotation
  - Automation of curation
- Errors in sourced data
  - Error listing
  - Manual curation
- Errors in manual annotation
  - Review step before actual submission in database
  - Manual curation
- Set up norm/guideline
  - Controlled vocabulary



# Translation Issues

50

- Variation in Subject classification standards
  - Dewey Decimal Classification (DDC)
  - Library of Congress Classification (LCC)
  - Library of Congress Subject Headings (LCSH)
- Mapping terminology for different languages
  - **Translate** when equivalent terminology is present
  - **Transliterate** otherwise



# NDL Metadata Extraction Toolkit

51

- Automated metadata extraction workflow
- Syntactic metadata extractor
  - Author name, ISBN, Publisher, dates etc.
- Table of content extractor
- Wikification for keyword extraction
- Learning resource metadata
- Toolchain for metadata extraction

*Once completed and tested, the toolkit will be released to public and open-sourced*

## Experience Tracking and UI

- Experience Tracking
  - To offer customized search results
- Multi-lingual Support
  - Reduce cognitive load for native use
- Personalization
  - Customized UI to suit user grade



Source: <http://www.brandquarterly.com/tracking-customer-experience-essential>

# Experience Tracking Technology

**Record:**

*Partha searched 'tiger'*

*Partha navigated to Tiger Wiki*

*Partha studied Wiki (3 min)*

*Partha downloaded tiger image (4 images)*

*Partha checked tiger map (2 min)*

*Partha enlarged map at Sunderbans (twice)*

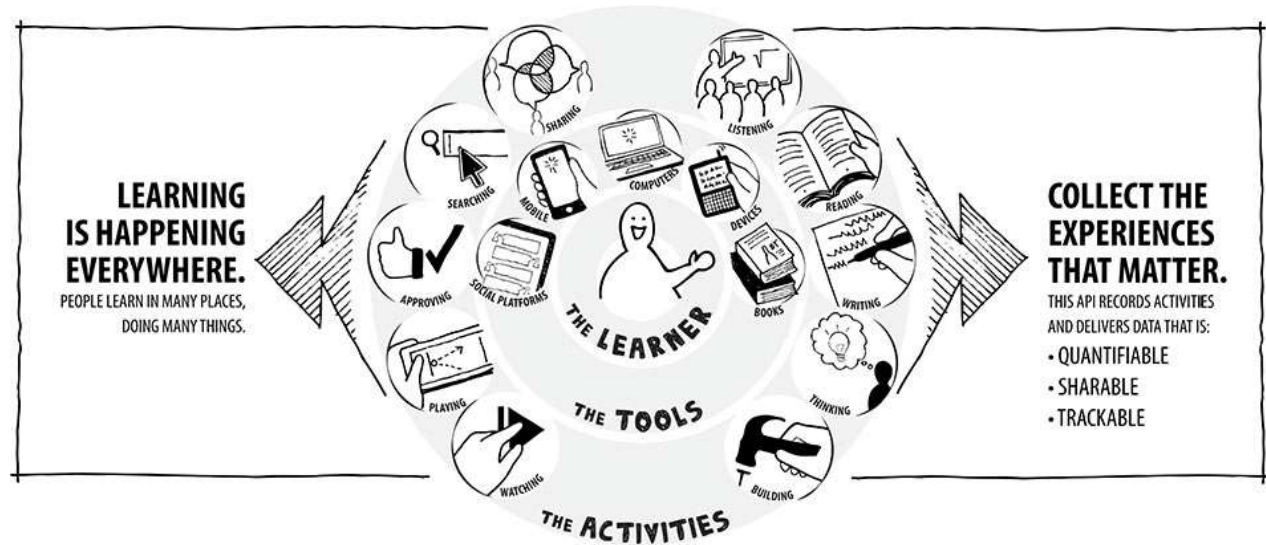
*Partha searched 'national animal of India'*

**Infer:**

Partha learnt – tiger is the national animal (of India)

... possibly

- **Experience API (xAPI) / Tin Can API**
  - Connects learning content and learning systems to record and track all types of learning experiences
- **Learning Record Store (LRS)**
  - Stores learning experiences



Source: <https://tincanapi.com/overview/>

## UI Technology: Web Interface

### API End Points:

#### RestFul API endpoint

- CMS API, Index API  
and LMS API

#### Parameterized access to the index

#### API Sandbox

- Web interface is an app using NDL API
- Extended Search Features
  - Facet based search result refinement
  - DDC Topic tree based content browsing
  - Tag, comment on a content
  - Target group specific interface
  - Bookshelf
  - Rating and sharing
- NDL-Specific Features
  - Multi-lingual enablement
    - ✦ Multi-lingual query interface powered by Google transliteration
    - ✦ Cross-lingual search
  - Personalization



# Copyright & License

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**HOW DOES NDL COPE WITH  
COPYRIGHT AND LICENSING ISSUES**



## Copyright Act, 1957 (Amendment 2012)

### Is metadata copyrighted?

Yes / No / May be

### Copyright of Metadata is contested

Source:  
<http://li.libraryjournal.com/2013/02/opinion/peer-to-peer-review/metadata-and-copyright-peer-to-peer-review/>



- Copyright is a bundle of rights given by the law to
  - Creators of literary, dramatic, musical and artistic works and
  - Producers of cinematograph films and sound recordings
- Rights are:
  - reproduction of the work,
  - communication of the work to the public,
  - adaptation of the work and,
  - translation of the work
- Creator / Author is the first Owner
- Ownership (Title) can be transferred (assigned)



## Copyright of Metadata

- **NDL principles as follows:**
  - Vast Majority of Metadata is Not Subject to Copyright Restrictions
  - NDL's Partners Share the NDL's Commitment
  - NDL Asserts No Rights Over its Database of Metadata and Dedicates its Contributions to the Public Domain
  - Free and Unencumbered Access to Metadata

Adapted from: <https://dp.la/info/wp-content/uploads/2013/04/DPLAMetadataPolicy.pdf>



## License Mechanisms

- Content Access Views in NDL
  - Metadata View
    - ✦ This shows the metadata of the item – as maintained in NDL
  - Full Text View
    - ✦ This shows the view and provides access to full text – offered by the content source

*A license encapsulates the rights & privileges that a copyright holder grants to someone else vis-a-vis something they have created*



# Content Access View: Metadata

59

The screenshot shows a web browser window with several tabs open. The active tab is 'National Digital Library'. The address bar contains the URL 'ndl.iitkgp.ac.in/content.php?id=MTIzNDU2Ny83NjMzMDQ='.

The page header includes the National Digital Library logo, navigation links for 'Content' and 'Metadata' (the latter is circled in red), and user information for 'Parthapratim'.

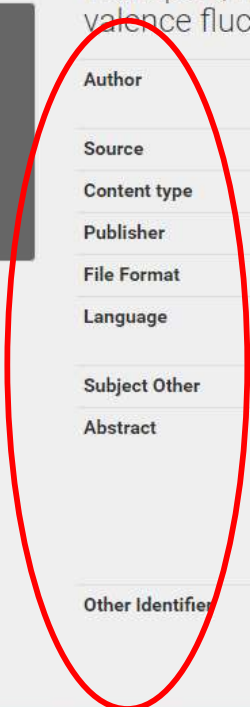
The main content area displays the title 'Transport, magnetic, and Sn-119 Mossbauer studies on magnetically ordered valence fluctuating compound SmRuSn3'. Below the title is a metadata table with the following entries:

Author	Mazumdar, C. ♦ Hossain, Z. ♦ Nagarajan, R. ♦ Godart, C. ♦ Dhar, S. K. ♦ Gupta, L. C. ♦ Padalia, B. D. ♦ Vijayaraghavan, R.
Source	<a href="#">IIT Bombay</a>
Content type	Text
Publisher	AMER INST PHYSICS
File Format	HTM / HTML
Language	English
Subject Other	cerus3
Abstract	SmRuSn3 is a unique compound among the known Sm-based valence fluctuation (VF) systems. Its crystallographic structure has two inequivalent Sm sites and Sm ions at only one of them are in VF state while the Sm ions in the other site orders magnetically. Our (119)Mossbauer studies show a quadrupolar splitting at the Sn site, consistent with the noncubic symmetry of the Sn site. A broadening of the Mossbauer spectrum is seen due to magnetic ordering of the material. The transferred hyperfine field at Sn site at 4.2 K is small. (C) 1996 American Institute of Physics.
Other Identifier	JOURNAL OF APPLIED PHYSICS,79(8)6349-6351 0021-8979 <a href="http://dx.doi.org/10.1063/1.361996">http://dx.doi.org/10.1063/1.361996</a> <a href="http://hdl.handle.net/100/1441">http://hdl.handle.net/100/1441</a>

At the bottom of the page, there is a navigation bar with links for 'About', 'FAQ', 'Disclaimer', 'Help', 'Statistics', 'Feedback', 'Social', 'Sponsor', and 'Contact'.



**Source Page is rendered within NDL showing free Metadata**





# Content Access View: Full Text






60

The screenshot shows a web browser window with the URL `ndl.iitkgp.ac.in/content.php?id=MTIzNDU2Ny83NjMzMMDQ=`. The browser's address bar and tabs are visible at the top. The page content includes a navigation menu with 'Content' highlighted in a red circle. The main content area displays the title 'Transport, magnetic, and Sn-119 Mossbauer studies on magnetically ordered valence fluctuating compound SmRuSn3' and a metadata table. The 'URI' field in the metadata table is circled in red, containing three links: `http://dx.doi.org/10.1063/1.361996`, `http://dspace.library.iitb.ac.in/xmlui/handle/10054/14612`, and `http://hdl.handle.net/100/1441`. The abstract text is also visible, describing the compound's structure and the Mossbauer studies. The browser's taskbar at the bottom shows various application icons and the system tray with the date and time.

Full-Text  
URL from  
Source

# Access Options

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	<b>Open</b> Full-text available to all (Example: NCERT)
	<b>NDL Users</b> Full-text available through NDL, <i>not directly</i> from Source (Example: South Asia Archive)
	<b>Limited Access</b> Part of text available but full-text requires authorization by Source authority (Example: IISER, Bhopal)
	<b>Subscribed</b> Full-text available from institutions that have subscribed to the Source (Example: Springer)
	<b>Restricted</b> Full-text access requires authorization by Source authority and separate login to the Source (Example: IIT Jodhpur)

# National Licensing

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- An initiative by eSS:
  - **e-ShodhSindhu**: Consortium for Higher Education Electronic Resources



- Licensing being negotiated with Publishers
  - **Institutional License**:
    - ✦ Accessible from within designated institutional network: **IP filtered**
  - **NDL Supported License**:
    - ✦ Accessible if requested from NDL: **Concurrent use-basis**

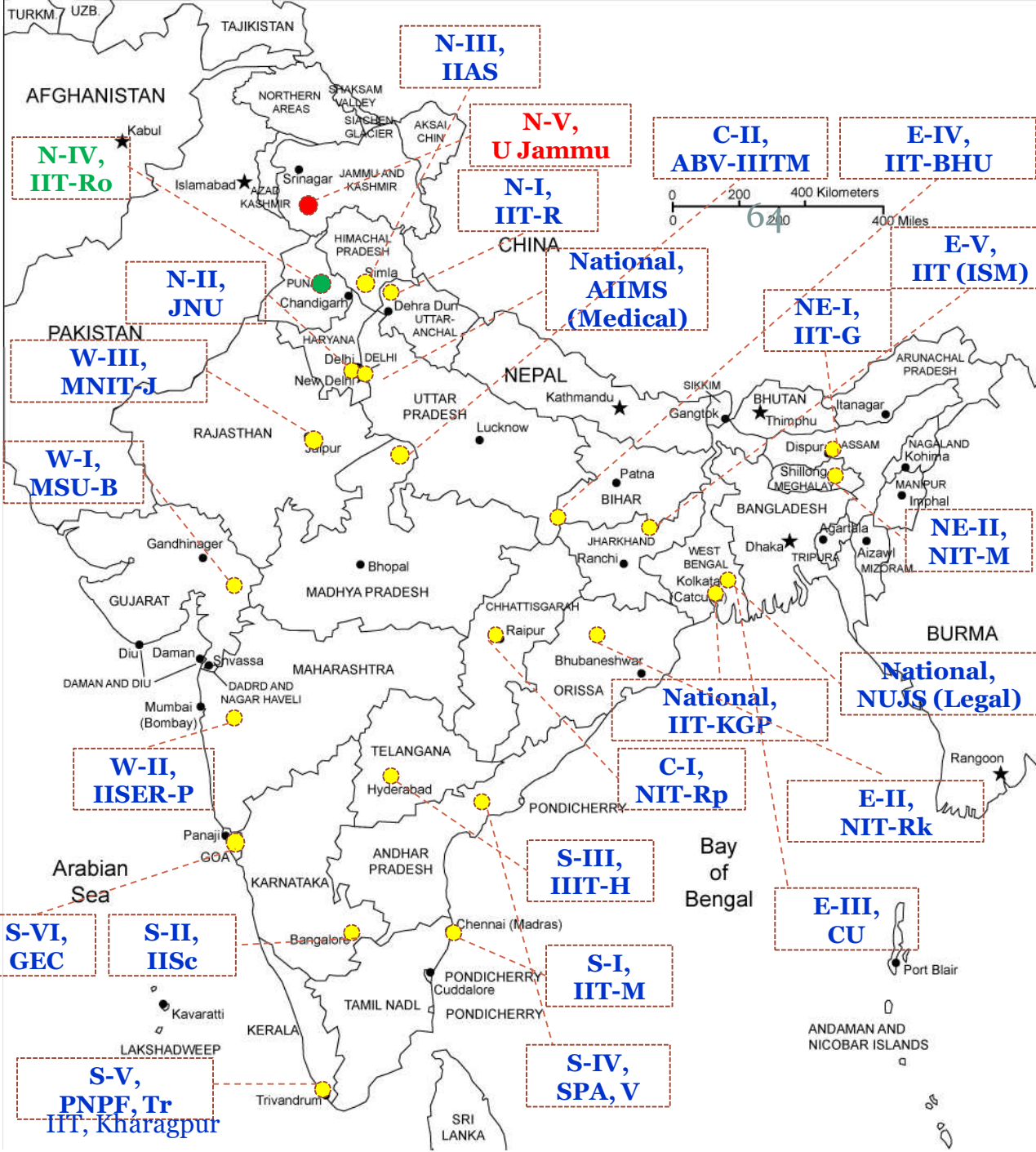


# Project Status

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# NDLI IDR Workshops



**Completed:**  
**Events: 25**  
**Institutes: 730**  
**Individuals: 1340**

**Scheduled:**  
**Events: 2**  
**Institutes: 60**  
**Individuals: 140**





## **NDLI Live:**

**<https://ndl.iitkgp.ac.in/>**

## **NDLI on Facebook:**

**<https://web.facebook.com/NDLIndia/>**

## **NDLI on YouTube:**

**<https://www.youtube.com/watch?v=LEwAyHGKeLw>**

**<https://www.youtube.com/watch?v=qIZB-G9ywFo>**

**<https://www.youtube.com/watch?v=UCoJwfPrQFs&t=115s>**

## **NDLI Project:**

**<http://www.ndlproject.iitkgp.ac.in/ndl/>**



# Publications

66

1. Debarshi Kumar Sanyal, **Semantic Search in Digital Library**, Presented in International Seminar on Digital Humanities and Digital Societies in the Contemporary World, January 18-19, 2018
2. T. Y. S. S. Santosh, Debarshi Kumar Sanyal, and Plaban Kumar Bhowmick, **Surrogator: Enriching a Digital Library with Open Access Surrogate Resources**, Proceedings of ACM India Joint International on Data Sciences and Management of Data (CoDS-COMAD), January 11-13, 2018.
3. Samrat Guha Roy, B. Sutradhar, Partha Pratim Das, **Large-scale Metadata Harvesting – Tools, Techniques and Challenges: A Case Study of National Digital Library (NDL)**, Presented in *International Conference on Digital Library, TERI New Delhi, Dec. 13<sup>th</sup> – 16<sup>th</sup>, 2016.*
4. Subhayan Roy and Plaban Bhowmick, **Augmenting Online Video Lectures with Topically Relevant Assessment Items**, *The 24<sup>th</sup> International Conference on Computers in Education, IIT Bombay, Nov 28<sup>th</sup> - Dec 2<sup>nd</sup>, 2016: Best Technical Design Paper*
5. Poonam Anthony and Plaban Bhowmick, **Architecture for User Experience Tracking and Analytics in National Digital Library (NDL)**, *The 8th IEEE International Conference on Technology for Education, IIT Bombay, Dec. 2<sup>nd</sup> -4<sup>th</sup>, 2016.*
6. The NDL Team, **National Digital Library: A Platform for Paradigm Shift in Education & Research in India**, *Science and Culture (published by: Indian Science News Association)*, vol. 82, No. 1-2, pp. 4-11, Jan.–Feb. 2016.
7. The NDL Team, **National Digital Library: Building a National Asset**, *YOJANA*, vol. 60, pp 19-23, Jan. 2016. *Also in Hindi, Bangla, Marathi, Gujarati, Punjabi, Urdu, Telugu, Kanada, Malayalam, and Tamil.*



# Status ...

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- Items: 16M+
- Metadata: Version 1.0 of Standard Published
- Sources: 164 (IDRs: 100+)
- Registered Users: 3.0M+
- Daily Website Hits: ~12K
- Android App Download: 8L+
- Daily Android / iOS Hits: ~10K
- Registered User Institutions: ~9K
- Languages: 20+
- Learning Resource type: 15+
- Subject domain:
  - Most of the major educational areas (except medical and law)
- Educational Level: School Level (Class-I to XII) ,UG and PG



# Status ...

68

- **Nature of Sources: 154 (IDRs: 100+)**
  - **Featured: 7**
    - ✦ Shodhganga, Shodhgangotri, Spoken Tutorial, SNLTR, OECD, Satyajit Ray Archives, JEE / GATE Questions & Solutions, South Asia Archives, WeL
  - **Crawled Repositories: 5**
    - ✦ NPTEL, Khan Academy, PhET, Project-OSCAR, LibriVox (audio books), PubMed
  - **Manually-annotated sources: 6**
    - ✦ NCERT, CBSE, Boards of WB, Tripura, AP, Karnataka, Kerala, Maharashtra
  - **MARC data from Publishers: 2**
    - ✦ CRC Press, Springer
  - **Through API: 1**
    - ✦ INFLIBNET N-LIST
- **Upcoming**
  - **Integration Underway**
    - ✦ Royal Society of Chemistry
    - ✦ American Society of Mechanical Engineers
  - **Exploration**
    - ✦ UNESCO, Gandhi Heritage Portal

## Summary

**The only thing that you absolutely have to know (may use Google, though), is the URL of NDL:**

[ndl.iitkgp.ac.in](http://ndl.iitkgp.ac.in)

**Rest you find in NDL**

**Why are you waiting?**

'The only thing that you absolutely have to know, is the location of the library.'



Albert Einstein

- An umbrella over all IRs of India
- User-Centric Design
  - Multi-lingual Indic Interface
  - Multi-faceted Search
  - Multi-modal Filters
  - User Experience Tracking for Personalization
- Rich Set of Contents
  - National Licensing
  - Domain / Usage -focused Verticals
- Metadata Engineering
  - Metadata Standard
  - Open Source Toolkit
- NDLServices
  - Open APIs for 3<sup>rd</sup> party development
- Platform for Educational Ecosystem where all stakeholders participate, contribute and benefit
- Spearheads **NDL Movement**