Web Personalisation

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Trinity College, Dublin

Promise Winter School 2012

A Potentially Misleading Visualisation

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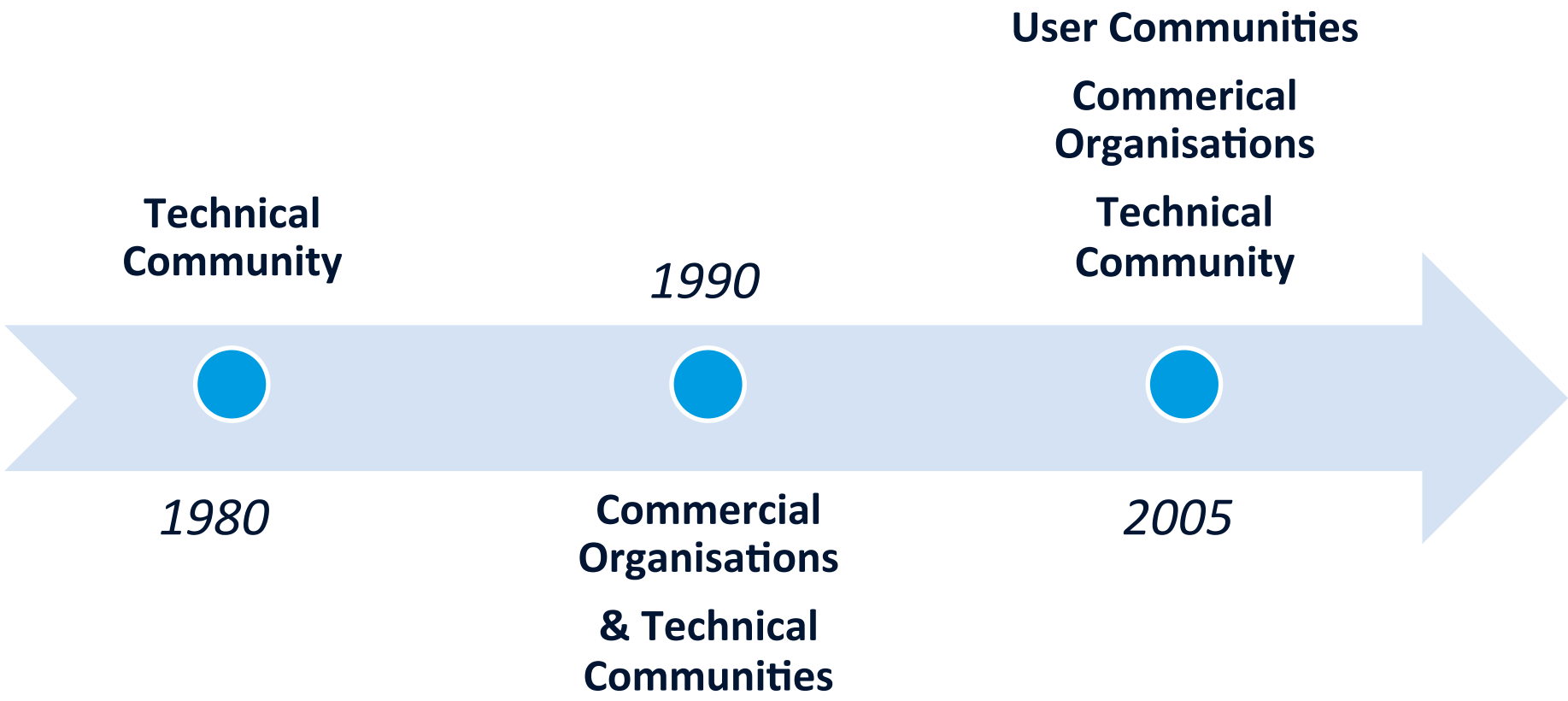
Problem: Human time and attention is finite

Motivation: Key Influencers of the Web

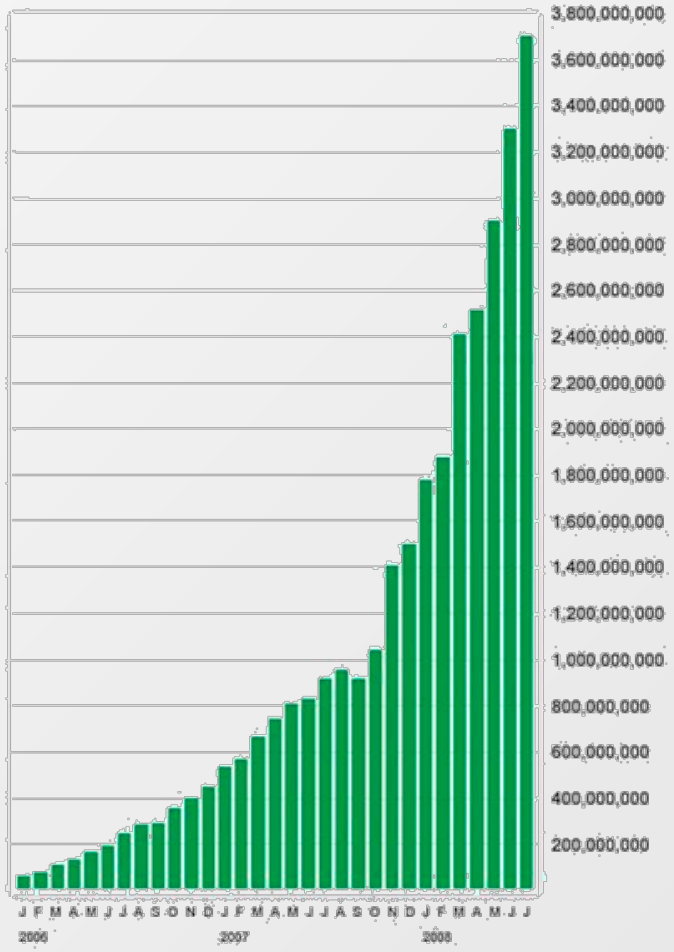


Towards a Future Internet – Interrelation between Technological, Social and Economic Trends", Final report DG Information Society and Media (Nov 2010)

Motivation: User-Generated Content

- Beginning to outpace professionally edited content
- New business models
  - Business Intelligence
  - Customer support
  - Customer loyalty
- Challenge:
  - Noisy data, ungrammatical, spelling, …
  - "Thank you for the wiki links, do you compiled adn updated list ?"

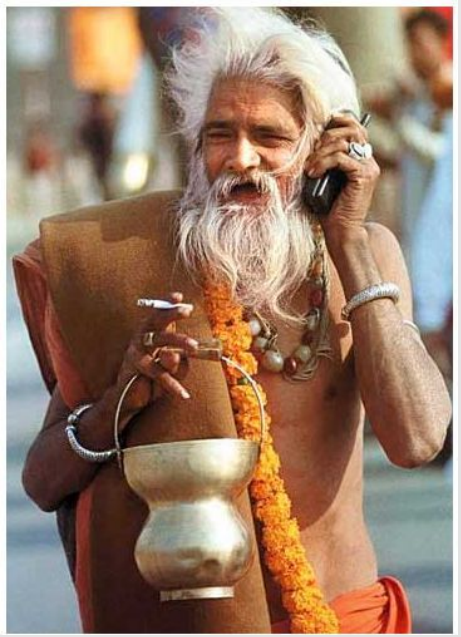
Motivation: The Mobile Web



- 2 Billion Web users
- 5+ Billion mobile phones

- Multimodal access/interactions

- Text
- Speech
- Video
- Pictures
- Audio
- …



Danger! Personalisation Bubble…

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- Using many signals the 'augment' a user's experience
  - Search History
  - Similar Users
  - Personal Relevance Grading!
- Over-specification/tuning of personalisation
- Constrained view of the world
- Adaptivity vs Adaptability

Potential Impact of Personalisation

- Mitigate Cognitive Overload
- Enhance cognition and cognitive gain
- Can reduce navigation efforts
- Reduce repetitive visits to pages
- Encourage non-sequential navigation
- Increase engagement/user outcomes
- Make system more engaging/motivating to user

Overview

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- What is Personalisation?
- What is Adaptive Hypermedia/ Adaptive Web?
  - Dimensions of Personalisation
  - Techniques for Adapting Content
  - Approaches to User Modelling
- History and Evolution of Adaptive Hypermedia
- Case Studies
  - CULTURA – Personalisation for Cultural Heritage
  - AMAS – Personalised Visualisations

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What is Personalisation?

Some Definitions

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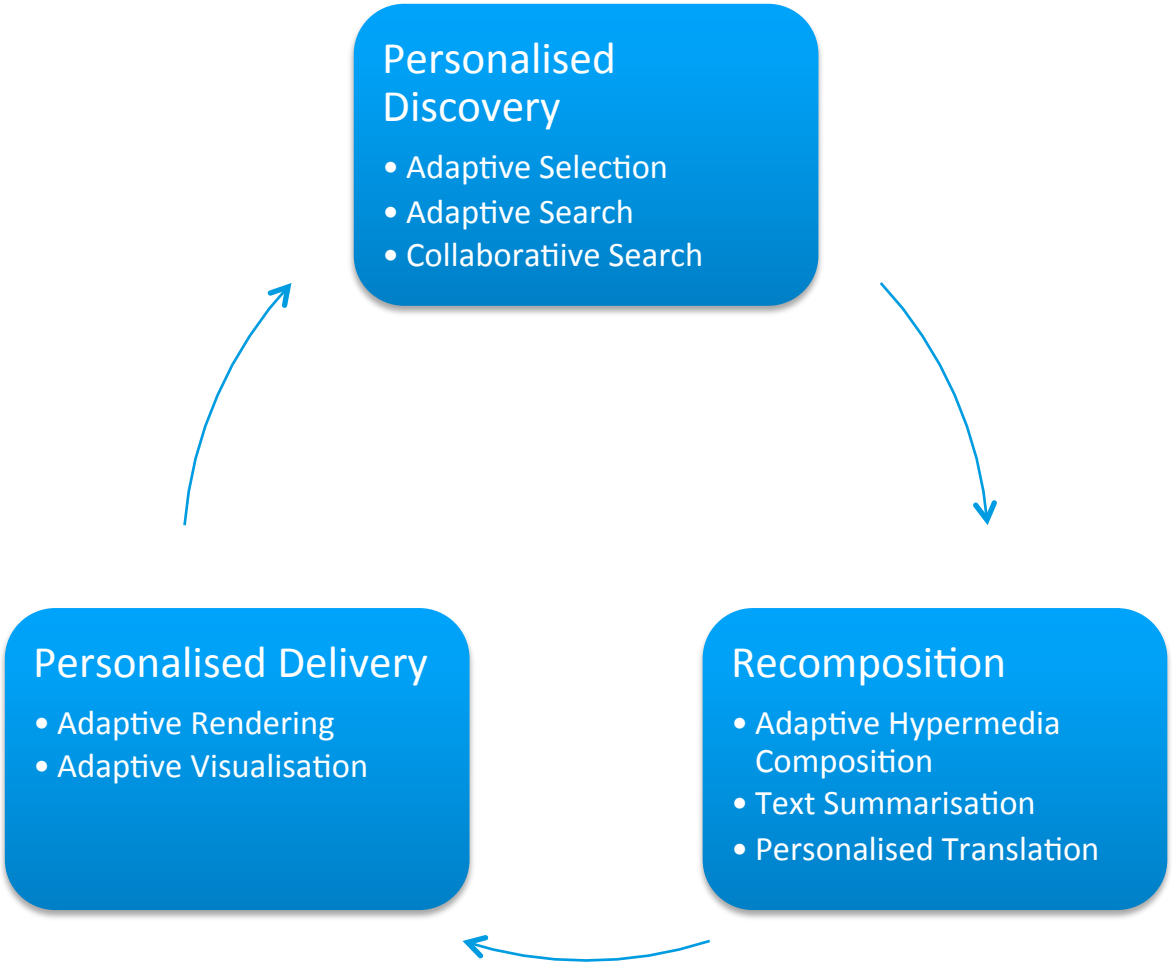
- Personalisation means a lot of different things to a lot of researchers, end users and marketeers!
- Personalisation *is* the adaptation (either automatically or user controlled) of all or part of the information delivery cycle for the benefit of one user or groups of user.
- Information Delivery Cycle consists of: Discovery, Analysis, Recomposition and Delivery of data, information or content on the Web

The Personalisation Process



What is Adaptive Personalisation of Digital Content ?

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"to achieve a more effective, efficient and satisfying user experience

By offering content, activities and collaboration,

adapted to the specific needs and influenced by specific preferences and context of the person,

based on the sound presentational strategies"

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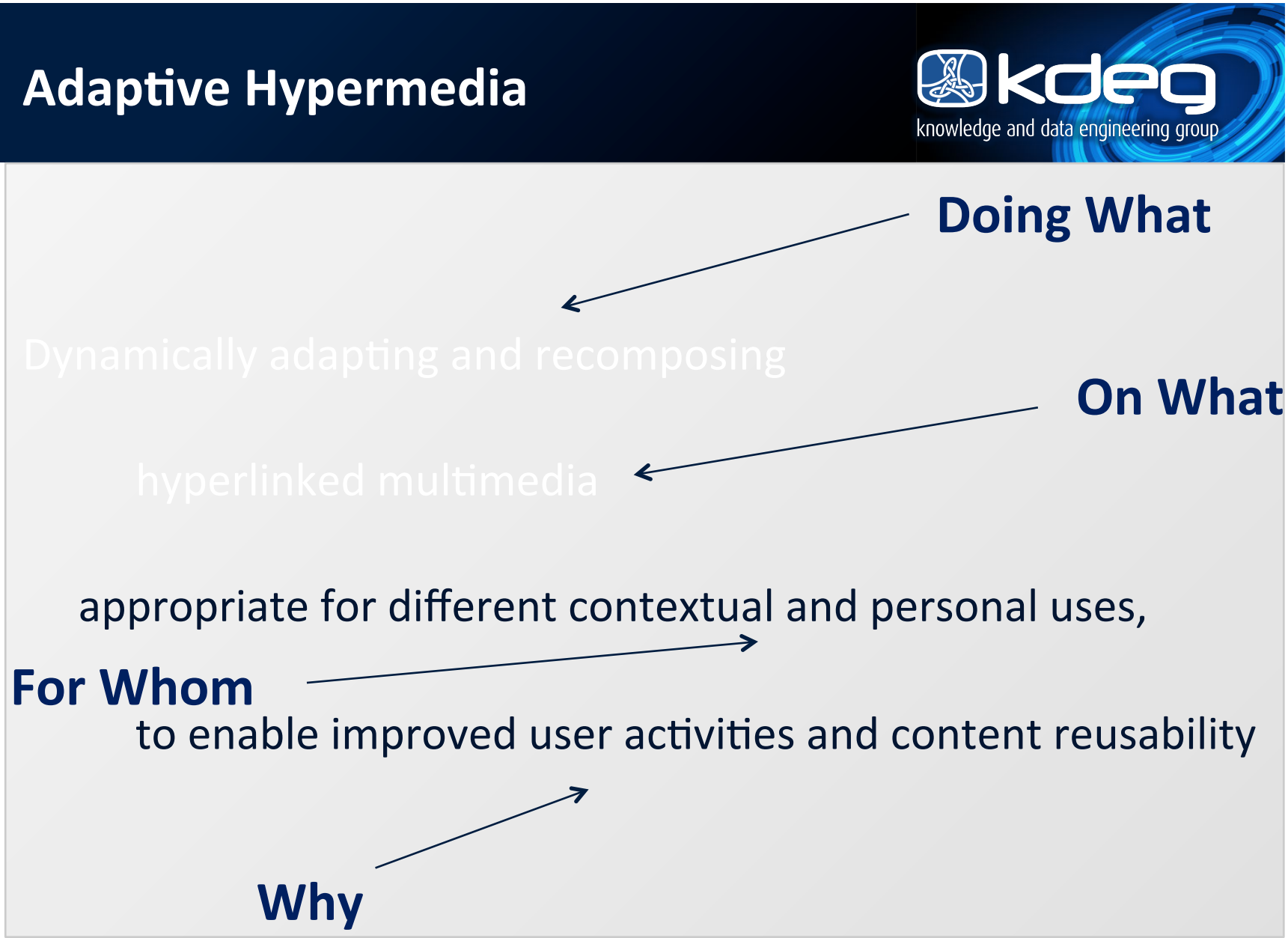
What is Adaptive Hypermedia/ Adaptive Web?

Adaptive Hypermedia



Adaptive Hypermedia Systems

- Can be thought of as a fusion of
  - Multimedia Content Management Systems

  and
  - Intelligent Web Systems

- Can adapt user's experience of the information or interface for different objectives and concerns

Motivation for Users

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- ‘One size doesn’t fit all’!
  - Different people have different needs, likes, preferences, skills, abilities …
  - Are in different locations, using different devices, With different connectivity
  - Are in different circumstances, using services for different reasons …
- Large variety of users, very variable circumstances, large ‘hyperspace’

Motivation for Content Providers

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- Digital Content typically very expensive to develop
  ⟹ need to ensure re-use
- Need to maximise ‘value’ of the content or message being transmitted by the content
- Need to automate ‘transformation’ process of digital content - to ensure greater usability

Where can Adaptivity for Hypermedia (web) be useful?

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- Web based Education (Technology Enhanced Learning)
- Web based Information Systems
  - Info. Kiosks, Tourists Info., Encyclopedias
- E-Commerce
  - 'Suggestive' web sites
- Museums
  - Virtual tours
- Information Retrieval Systems

Examples of Use

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- Web based Education
  - AHA!, KnowledgeTree, APeLS, AMASE, ELM-ART,
- Web based information systems
  - PEBA-II, AHA!, AVANTI, CULTURA
- Corporate Websites: E-Commerce
  - Active Catalogs, Amazon

Dimensions of Personalisation

What can we adapt about?

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- What do I mean by DIMENSIONS?
  - " .. any of the fundamental units on which a derived unit is based" *[Webster Dictionary]*
  - Think of dimensions as the AXES by which we can identify or within which we can form a solution

- 2 Minute Activity:
  - Turn to the person(s) beside you and **identify THREE things about which you think its important to personalise**

Dimensions

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- User Age
- User Disability
- Subject Pre-requisites
- Display Device
- User Role
- User Motivation
- User Language
- Preferred Modality (speech, text, video)
- User Prior Knowledge
- User Competencies
- User Experience/ History
- User Objectives
- User Emotion
- User Preferences
- Relationship to other subjects
- User Interests
- Time
- Performance
- Level of Control
- Activity/Task
- Process (rules)
- Interaction (with display)
- Group membership
- Group activity
- Deadline/Event
- Challenge
- Difficulty
- Relevance
- Progress
- Operating conditions
- Speed of device
- Volume of information
- Social Footprints
- Cost
- Complexity
- Availability
- User Goals
- User Behaviour

Challenge

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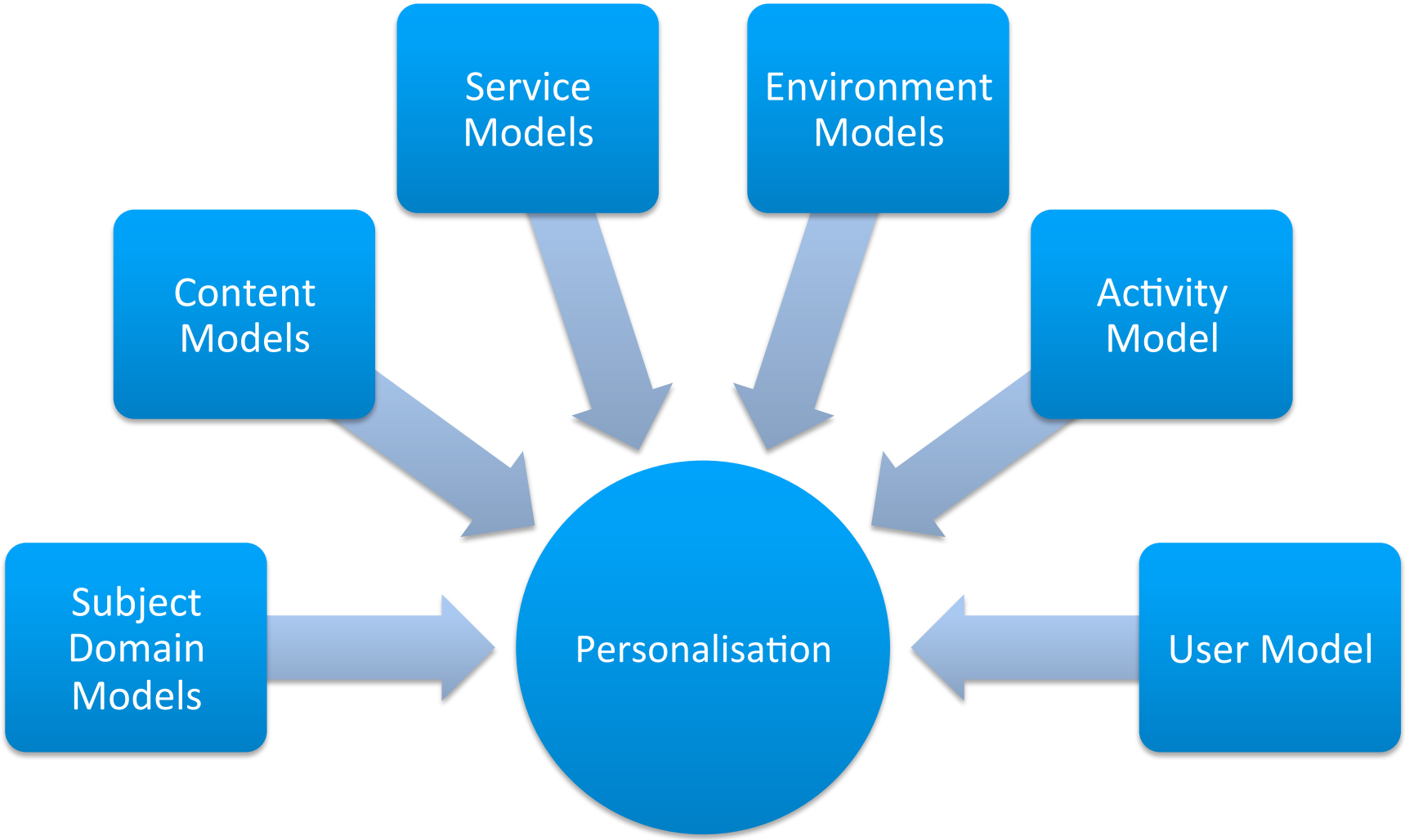
Need to consider:

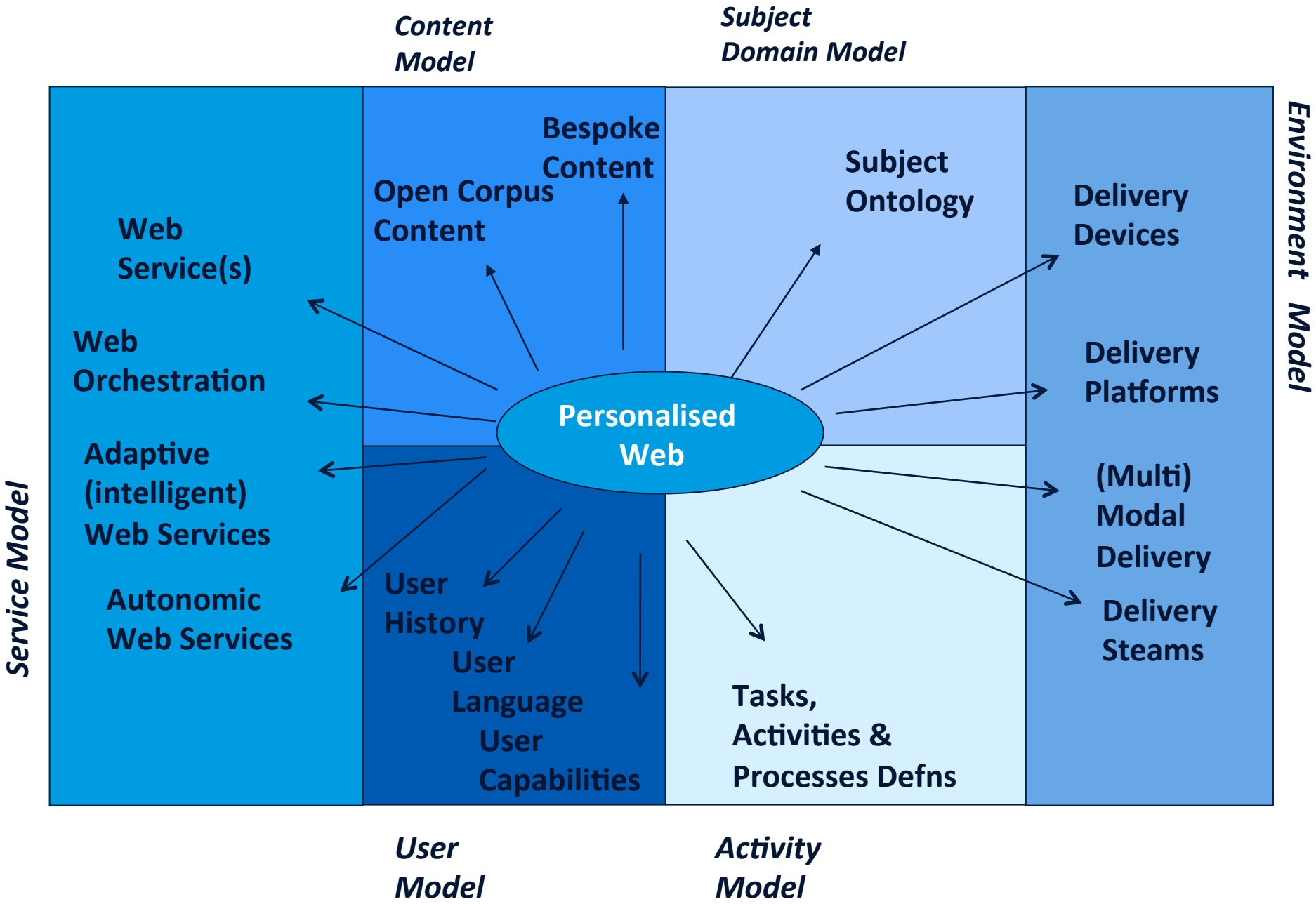
How do we cope with the huge number of things which can drive personalisation

how they can be supported within the

same integrated personal experience.

Dimensions → Models




Content Model
Subject Domain Model
Environment Model
Service Model
Bespoke Content
Open Corpus Content
Subject Ontology
Delivery Devices
Web Service(s)
Web Orchestration
Delivery Platforms
Personalised Web
Adaptive (intelligent) Web Services
(Multi) Modal Delivery
Autonomic Web Services
Delivery Steams
User History
User Language
User Capabilities
Tasks, Activities & Processes Defns
User Model
Activity Model

Representation Requirements

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Content Model

- Property based (ontological based, metadata)
- Typically based on a controlled vocabulary
- Difficulty dealing with linguistic issues

User Model

- Typically property based
- Probability based
- Evidence based (implicit or explicit)

Representation Requirements

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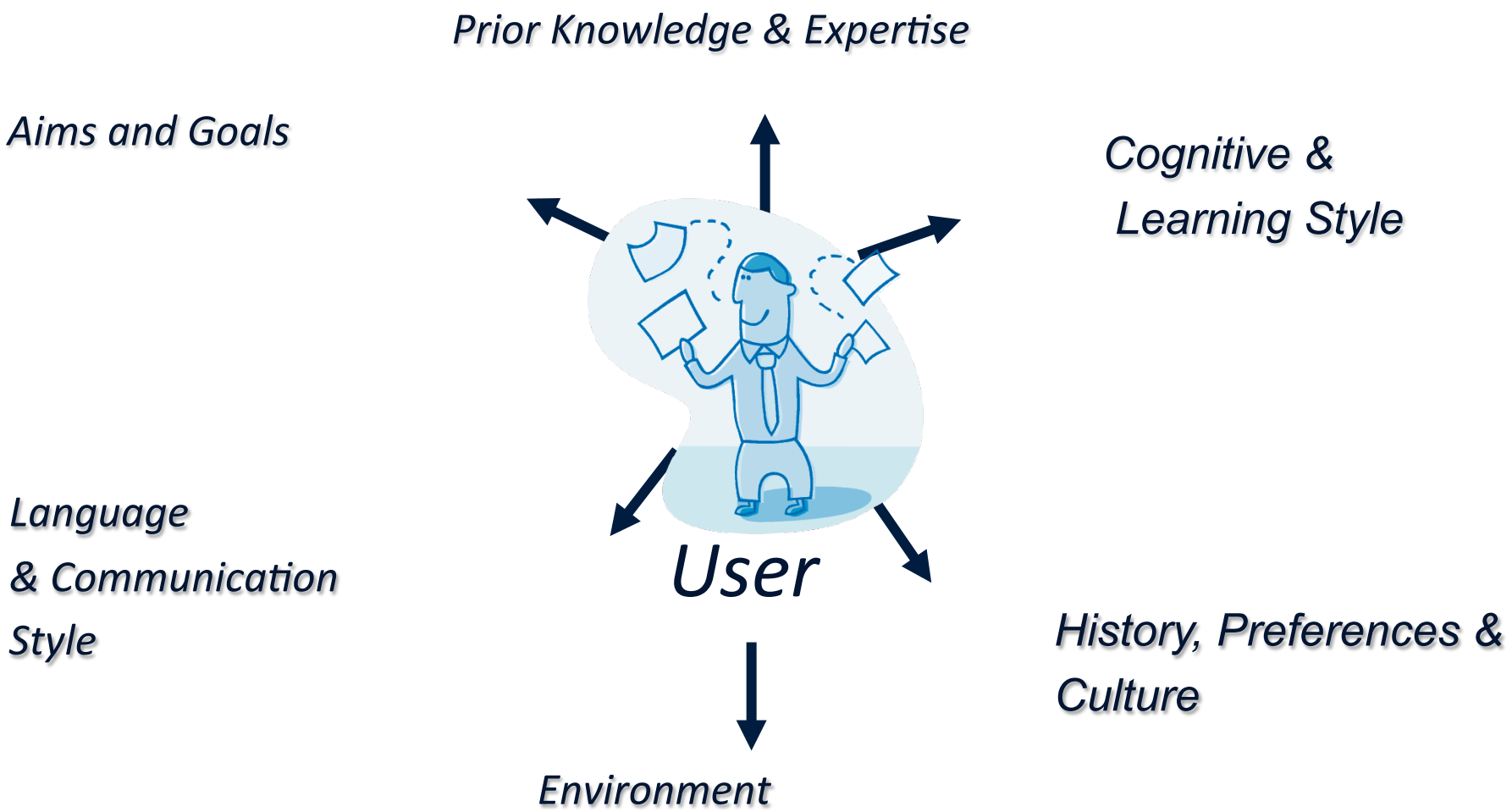
- Service Model
  - Typically static representation (service ontology based, interface based)
  - Need for representation of dynamic behaviour
  - Need for greater information flow representation
- Environment Model
  - Property based
  - Diversity of representation requirements e.g. Descriptive, constraint based, etc.


Prior Knowledge & Expertise
Aims and Goals
Cognitive &
Learning Style
Language
& Communication
Style
User
History, Preferences &
Culture
Environment

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Techniques for Adapting Content

Simple Axes of Adaptivity

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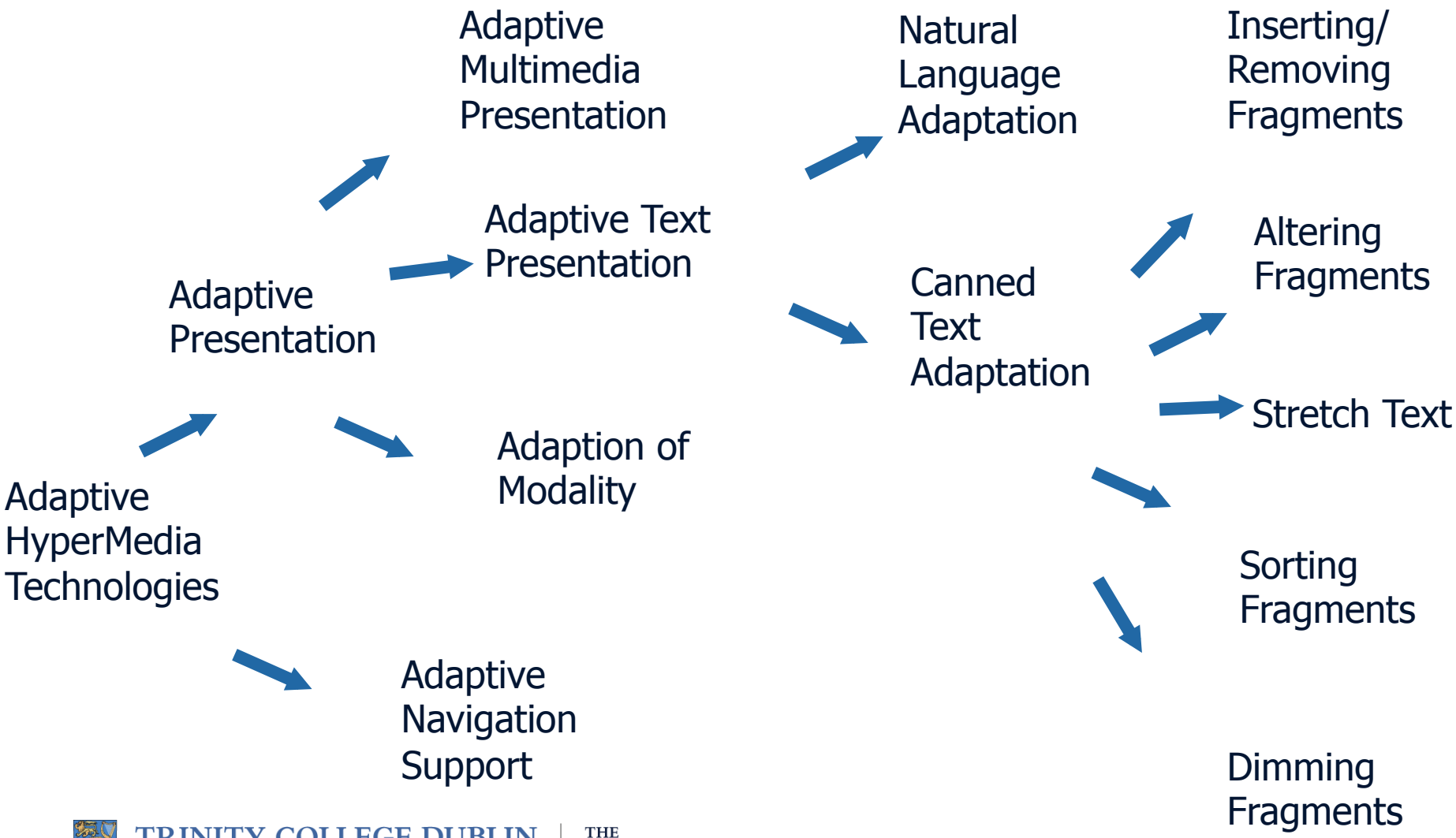
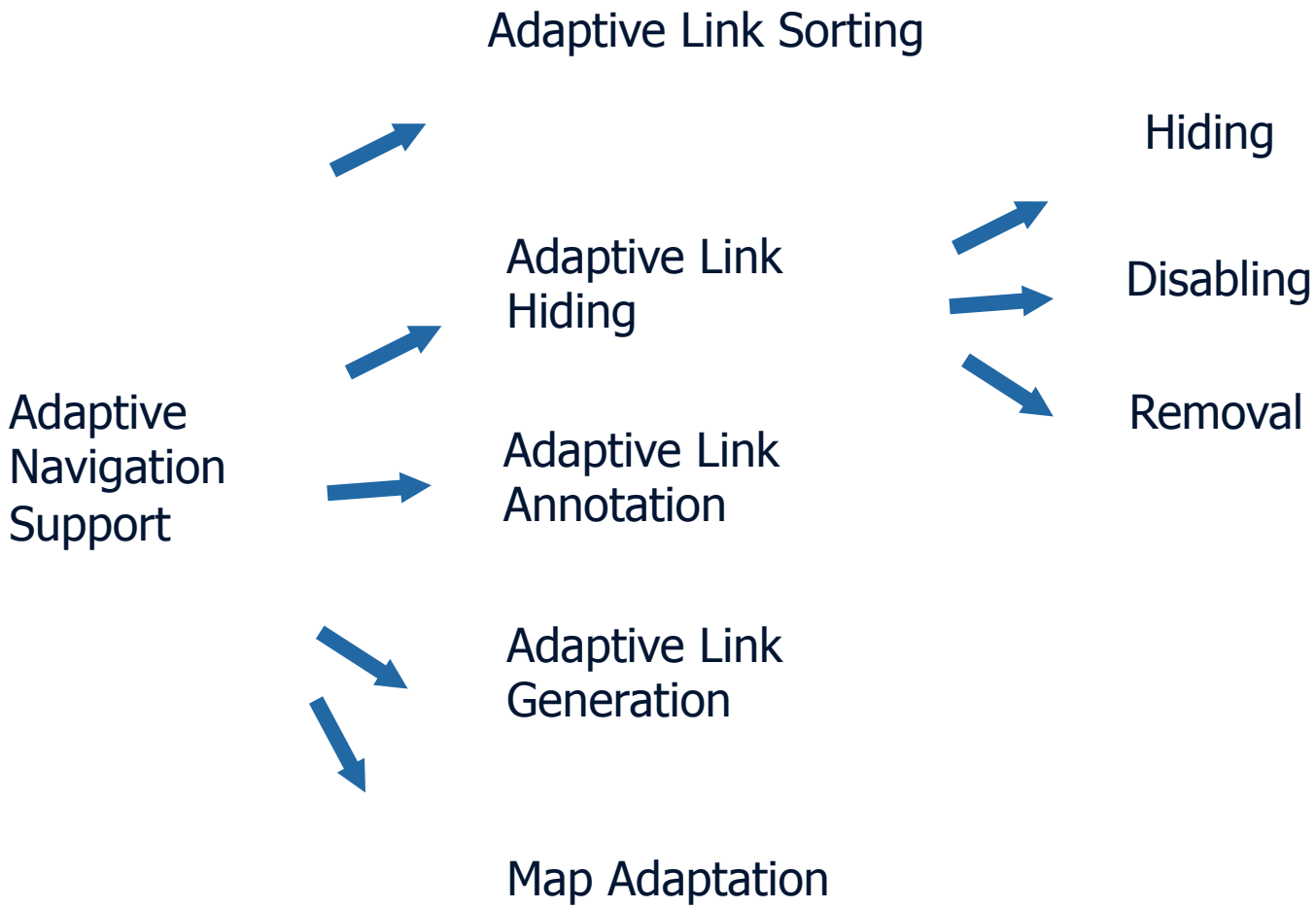
Adaptive Navigation
- Dynamically generated paths

Structural Adaptation
- Spatial representation of the Hyperspace environment

Adaptative Presentation
- Customization of content

Historical Adaptation
- Time context


Adaptive Hypermedia Technologies
Adaptive Presentation
Adaptive Multimedia Presentation
Adaptive Text Presentation
Adaption of Modality
Adaptive Navigation Support
Natural Language Adaptation
Canned Text Adaptation
Inserting/ Removing Fragments
Altering Fragments
Stretch Text
Sorting Fragments
Dimming Fragments


Adaptive Link Sorting
Hiding
Adaptive Link Hiding
Disabling
Adaptive Navigation Support
Removal
Adaptive Link Annotation
Adaptive Link Generation
Map Adaptation

Adaptive Presentation: Goals

- Provide the different content for users with different knowledge, goals, background etc….
- Provide additional material for some different users
- Remove/fade irrelevant piece of content
- Sort fragments e.g. most relevant first

Adaptive Presentation: Techniques

- Metadata-based Selection
- Conditional text filtering
  - e.g. altering fragments, extra explanations, extra details, comparisons
- Adaptive stretchtext
- Full natural language generation

Adaptive Navigation Support: Goals

- Guidance: Where can I go?
  - Local guidance (next best)
  - Global guidance (ultimate goal)
- Orientation: Where am I?
  - Local orientation (local area)
  - Global orientation (whole hyperspace)

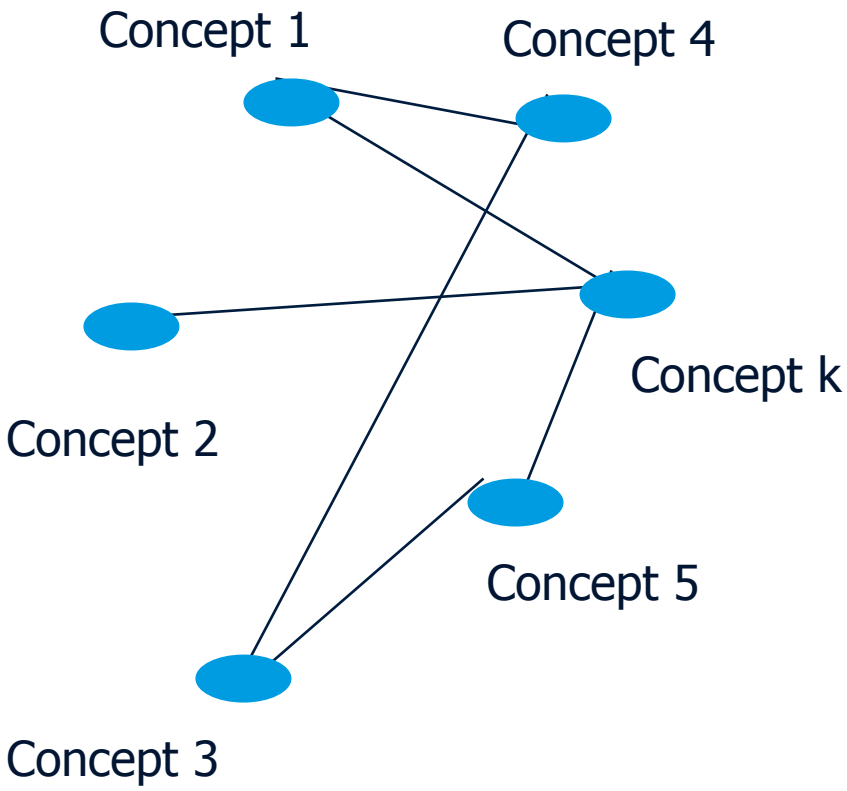
Adaptive Navigation: Support

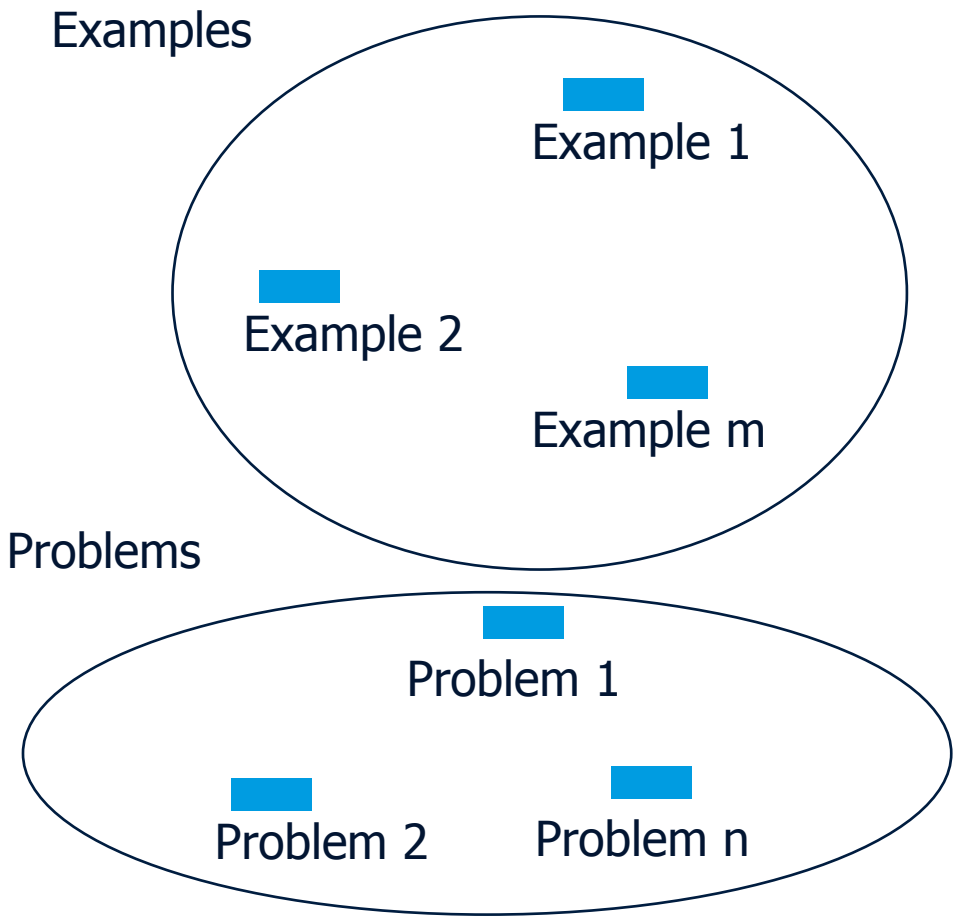
- Direct Guidance
- Restricting access
  - removing, disabling or hiding (links & pages)
- Sorting
- Annotation
  - e.g. coding of annotation
- Generation
- Map Adaptation Techniques

Adaptive Hypermedia - Domain Model Approach

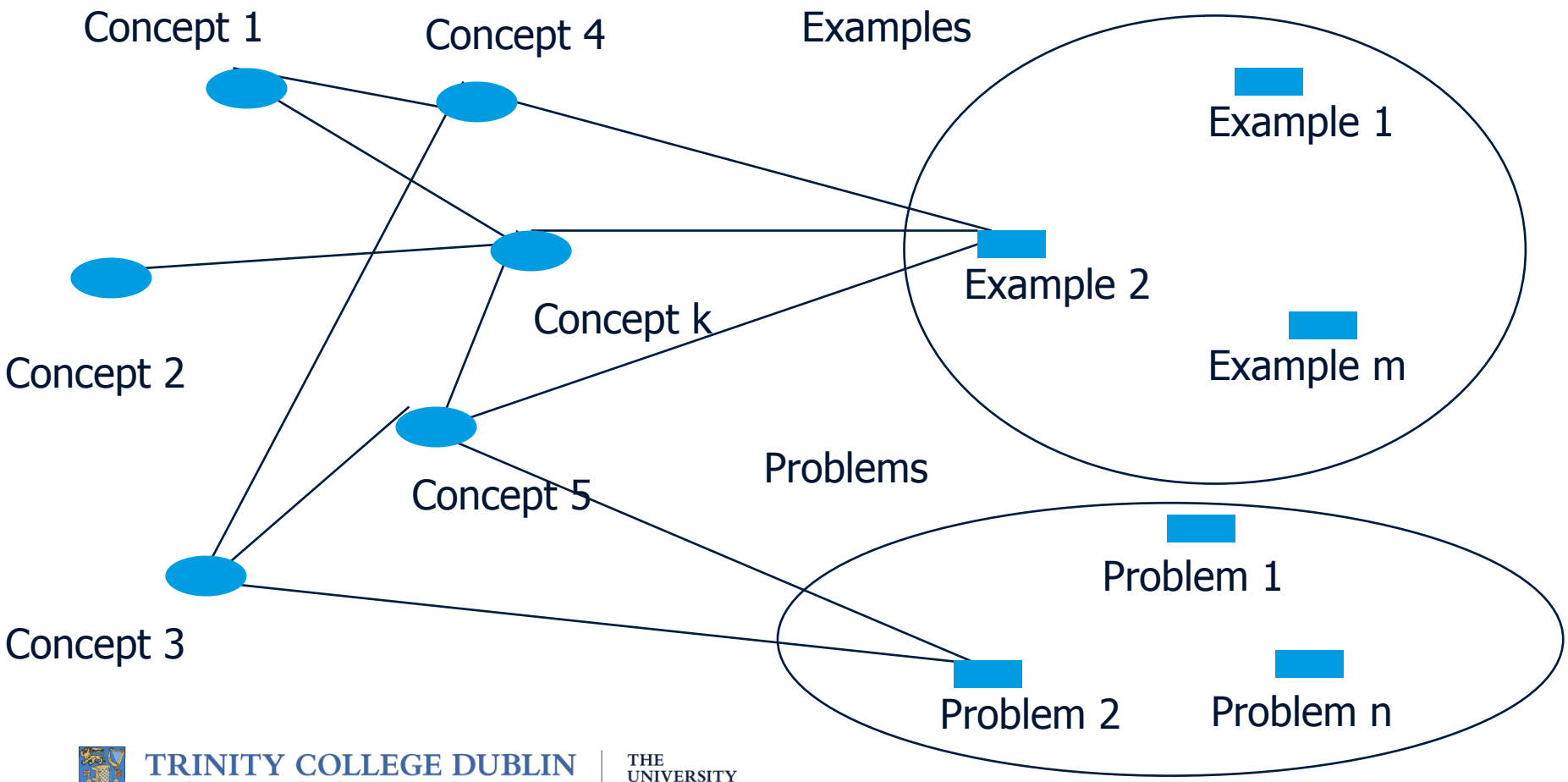
- Construct domain model containing
  - Concepts and constructs of the subject area
  - Relationships amongst concepts e.g. Pre-requisites, is-a, is-part-of etc.
- Also have representation of problems and examples about the area

Concepts, Examples and Problems





Indexing and Navigation



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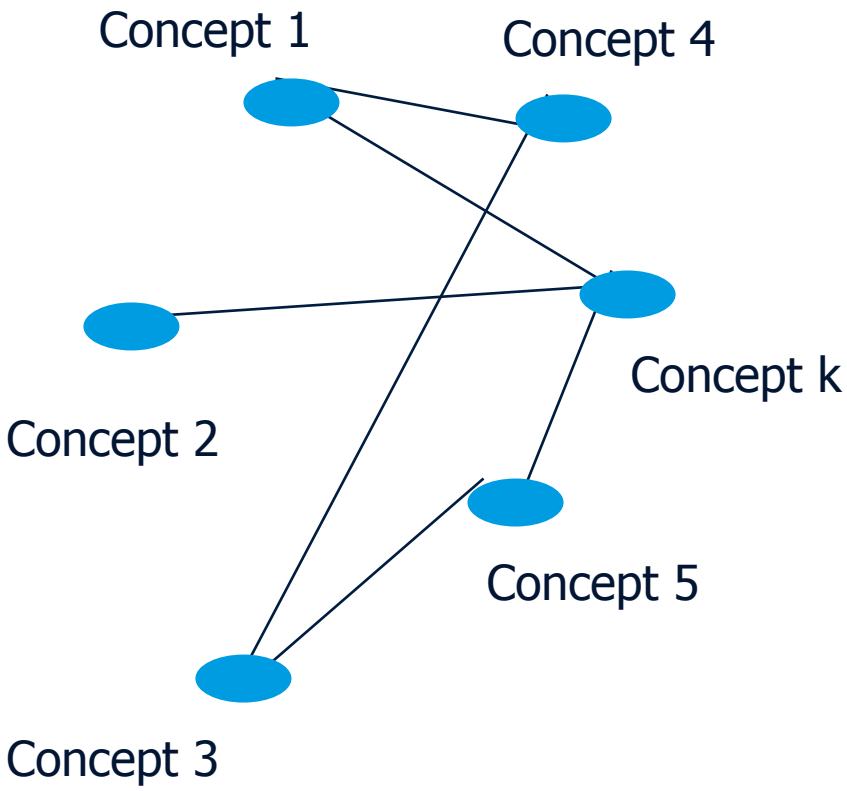

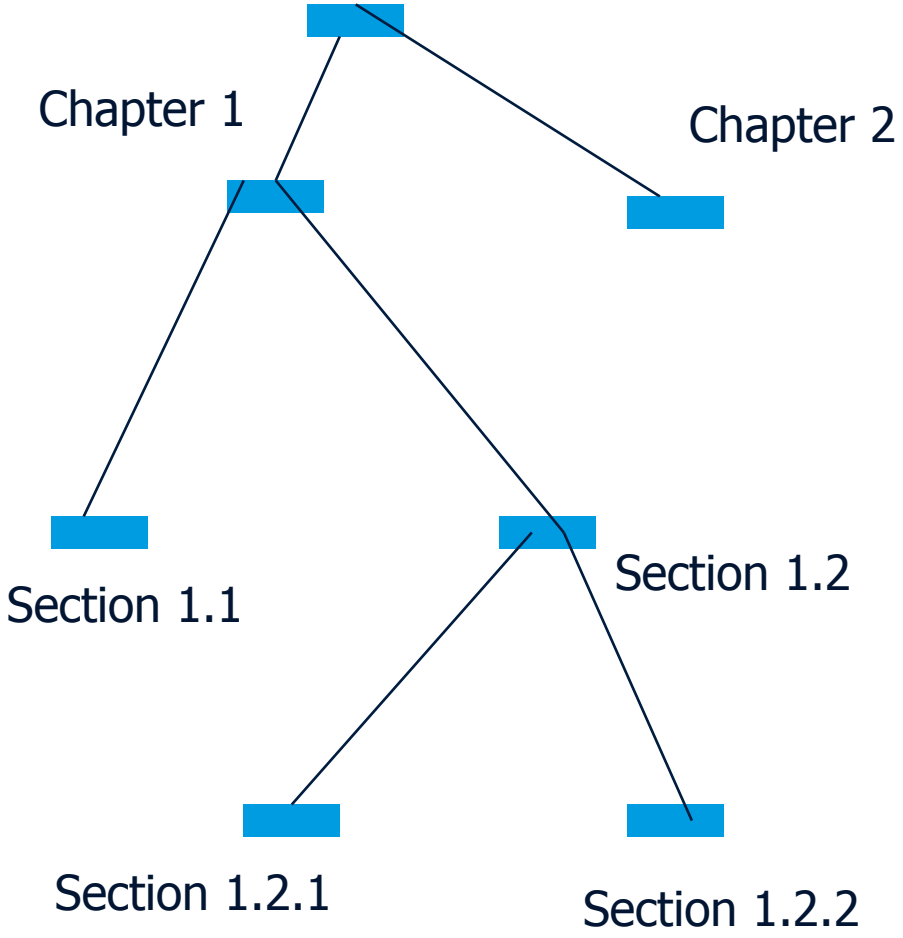

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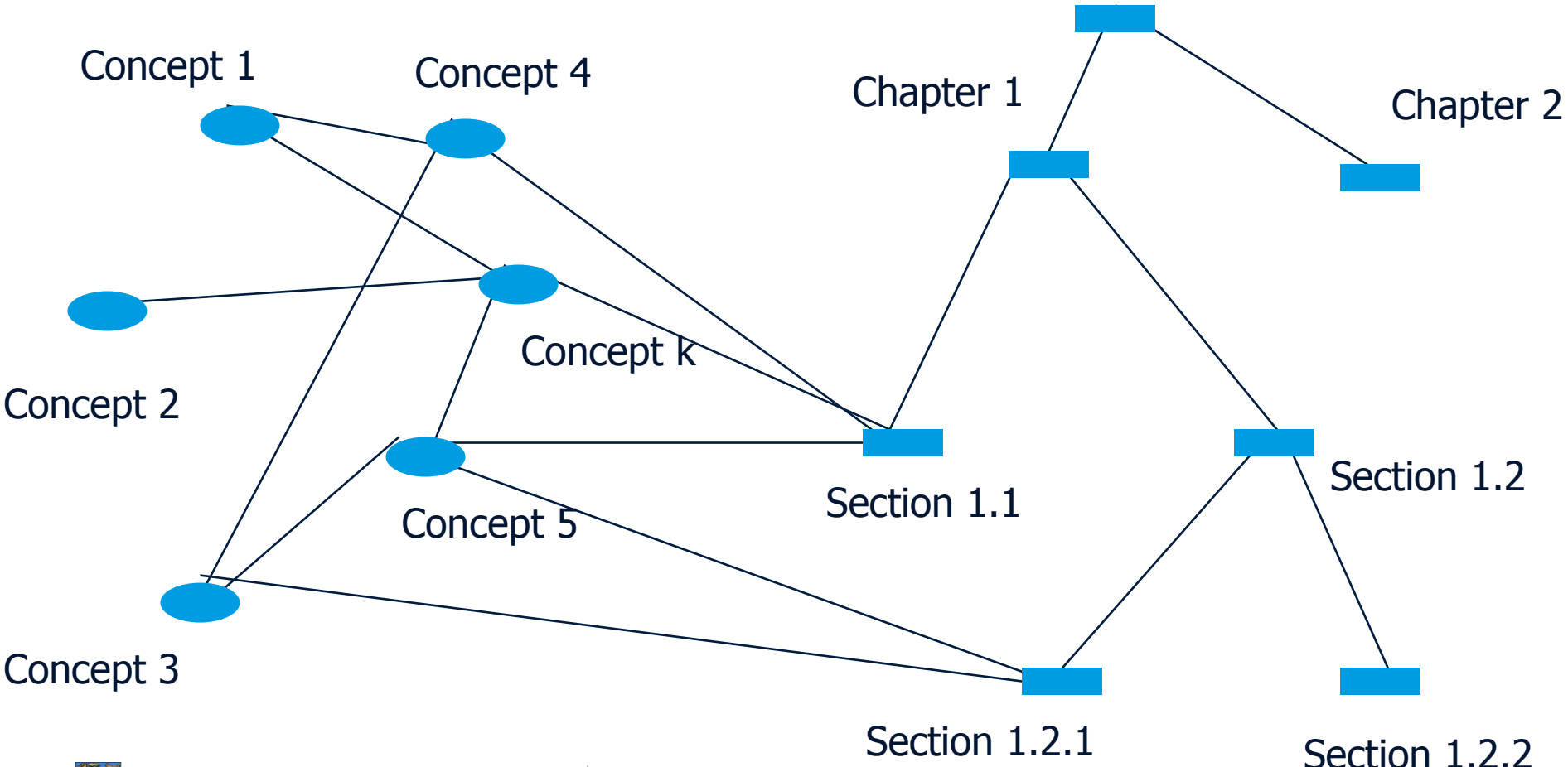

User Modelling

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- Simplest approaches (property based):
  - Event based (historical)
  - Overlay and Weighted overlay
  - Stereotypical
- More Complex:
  - Competency models
  - Knowledge spaces
  - Rule and inference based
  - :

User Modelling

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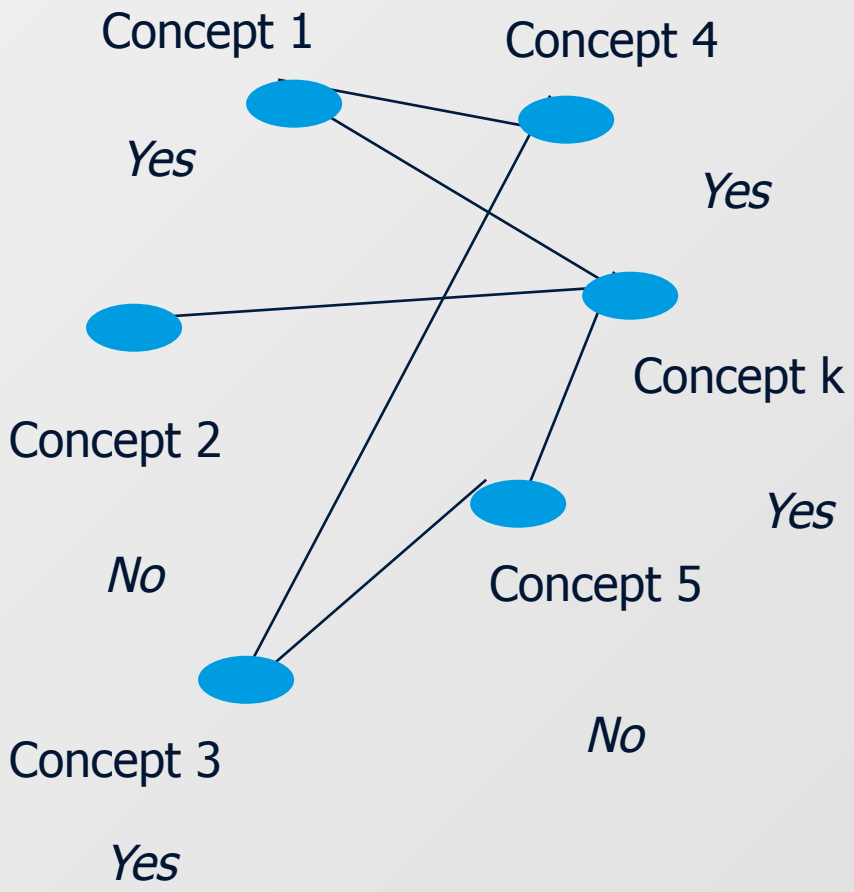
The Overlay approach to User Model

Simple Overlay Model

- Provide 'Yes'/'NO' for each concept in Domain Model

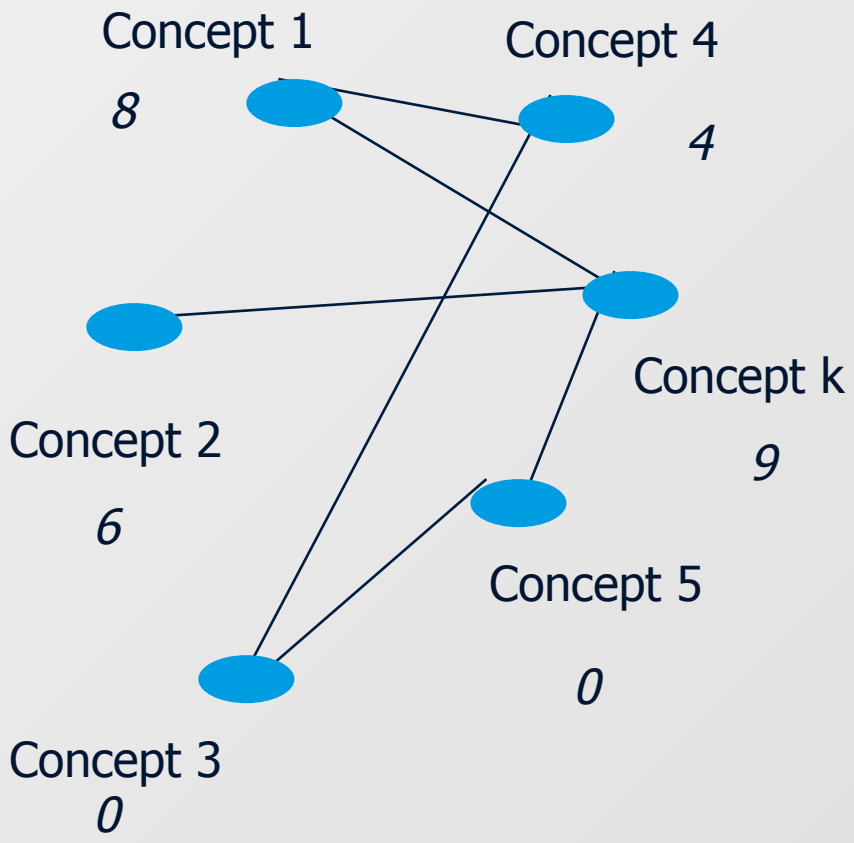


User Modelling

The Overlay approach to User Model

Weighted Overlay Model

- Provide weighting for users experience with each concept



Common approaches to implementing adaptive web systems

- Server Side Aspects
  - updated and store user model
  - generate content elements (table of contents, outcome concepts, …)
  - select fragments to include
  - provide annotations to links (or link hiding)
  - evaluation tests
  - interaction with external applications

Common approaches to implementing adaptive web systems

- Client Side Aspects
  - presentation of content & links
  - open/close, hide/grey-out text fragments
  - make link annotation visible
  - synchronisation of frames

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History and Evolution of Adaptive Hypermedia

Today's Adaptive Web Engines

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- 1st Generation Adaptive Hypermedia/Web
  - *Monolithic System,*
  - *Embedded Rules / intelligence within content*
  - *Programmer as Adaptivity Author*
  - *Application Specific*

e.g. AHA! V1.0
ELM-ART,
InterBook

1990 2000 2011 2016

Today's Adaptive Web Engines

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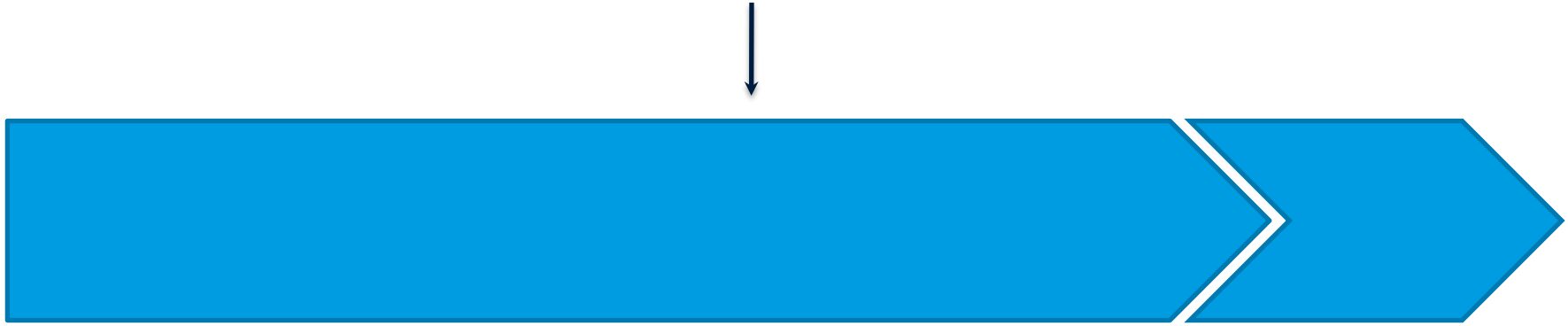
- 2nd Generation Adaptive Hypermedia/Web
  - *Multi Model Adaptivity*
    User, Content, Domain, Narrative
  - *Engine/Player based,*
  - *Candidacy of content (bespoke)*
  - *Model Developer as Adaptivity Author*



e.g. APeLS, AHAM

1990 2000 2011 2016

Today's Adaptive Web Engines

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- 3RD Generation Adaptive Web
  - Portal Based
  - Federated Models
  - Technical User as Author (Modeller)

e.g. Knowledge Sea AE, AHA! v4

1990 2000 2011 2016

Features of 3rd Generation Adaptive Engines

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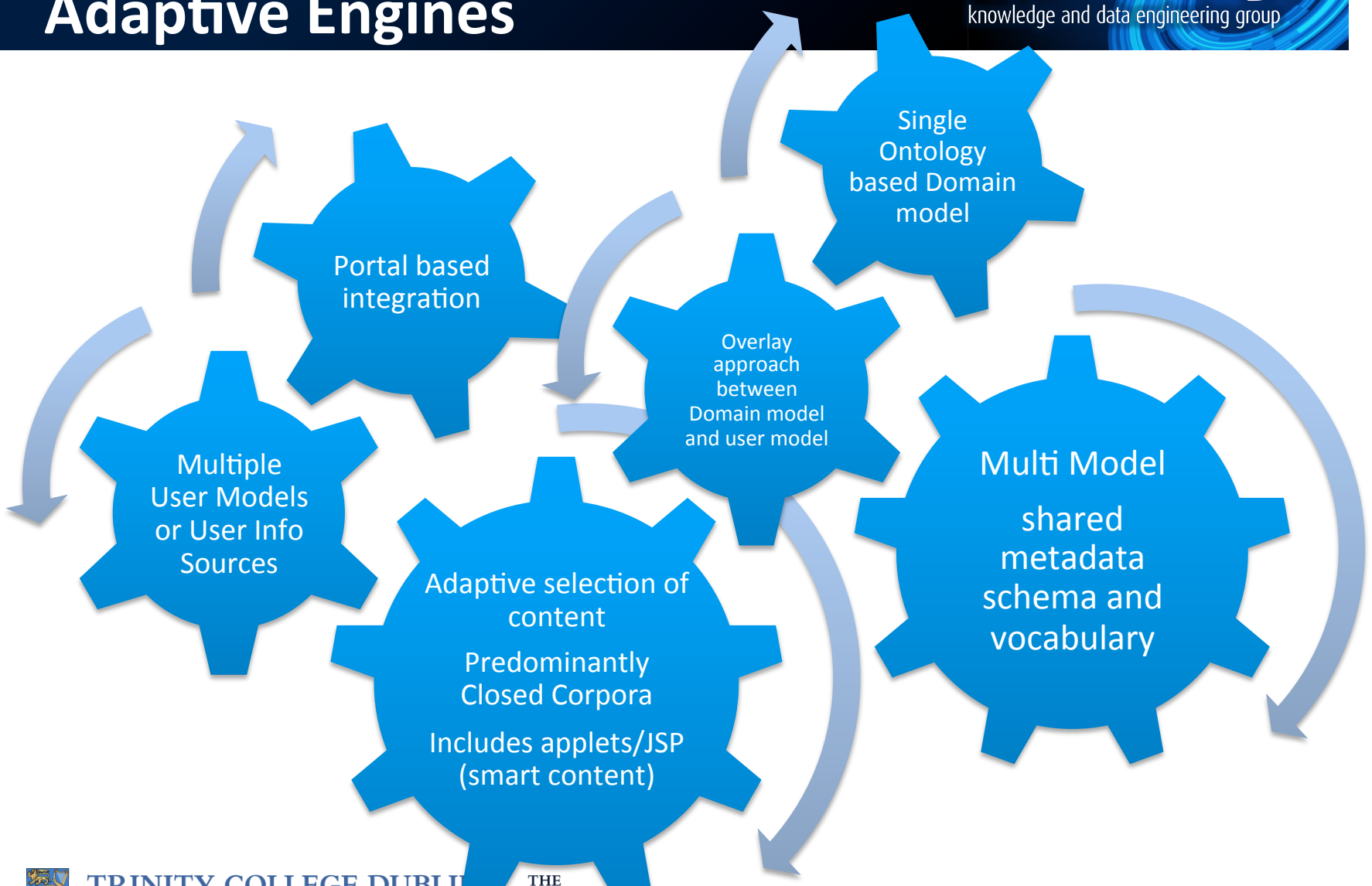

Today's Adaptive Web Engines

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- 1st Generation Adaptive Hypermedia/Web
- 2nd Generation Adaptive Hypermedia/Web
- 3RD Generation Adaptive Web
- Next Generation Adaptive Web ?

1990 2000 2011 2016

Tomorrow's Adaptive Web Engines

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- Multi-Dimensional Adaptivity
- Independent Adaptation Language
- Composition of Services and Content
- Meta-Adaptation
- End User Authored


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CASE STUDY 1: CULTURA – Towards Multi-Dimensional Adaptation

Mission

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… will pioneer the development and fusion of dynamic personalisation, contextual adaptivity and social analysis in a digital humanities context

CULTURA – Challenges

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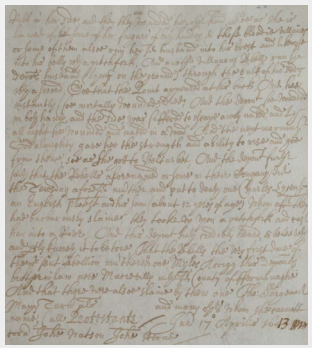
CULTURA will pioneer the development of next generation adaptive systems which will provide new forms of ***multi-dimensional adaptivity***:

- personalised information retrieval and presentation which respond to **models of user and contextual intent**
- community-aware adaptivity which responds to **wider community activity, interest, contribution and experience**
- content-aware adaptivity which responds to the **entities and relationships automatically identified within the artefacts and across collections**
- personalised **dynamic storylines which are generated across individual as well as entire** collections of artefacts

What Digital Humanities artefacts?

CULTURA will be validated and evaluated –

- by representative communities formed around contrasting, high-impact, multi-cultural heritage collections in different languages
- **via two contrasting digital humanities artefact collections** involving both textual artefacts and image-based artefact collections (the 1641 Depositions; and the *Imaginum Patavinae Scientiae Archivum* (IPSA) collection)



Who are the CULTURA 'users'?

Diverse mixture of …

- professional researchers in history and humanities
- apprentice investigators (e.g. students of culture and history)
- informed users (e.g. users belonging to relevant societies or interest groups, cultural or authorities)
- members of the general public (both adults and children)

… with diverse interests and motivations.

CULTURA Ingredients

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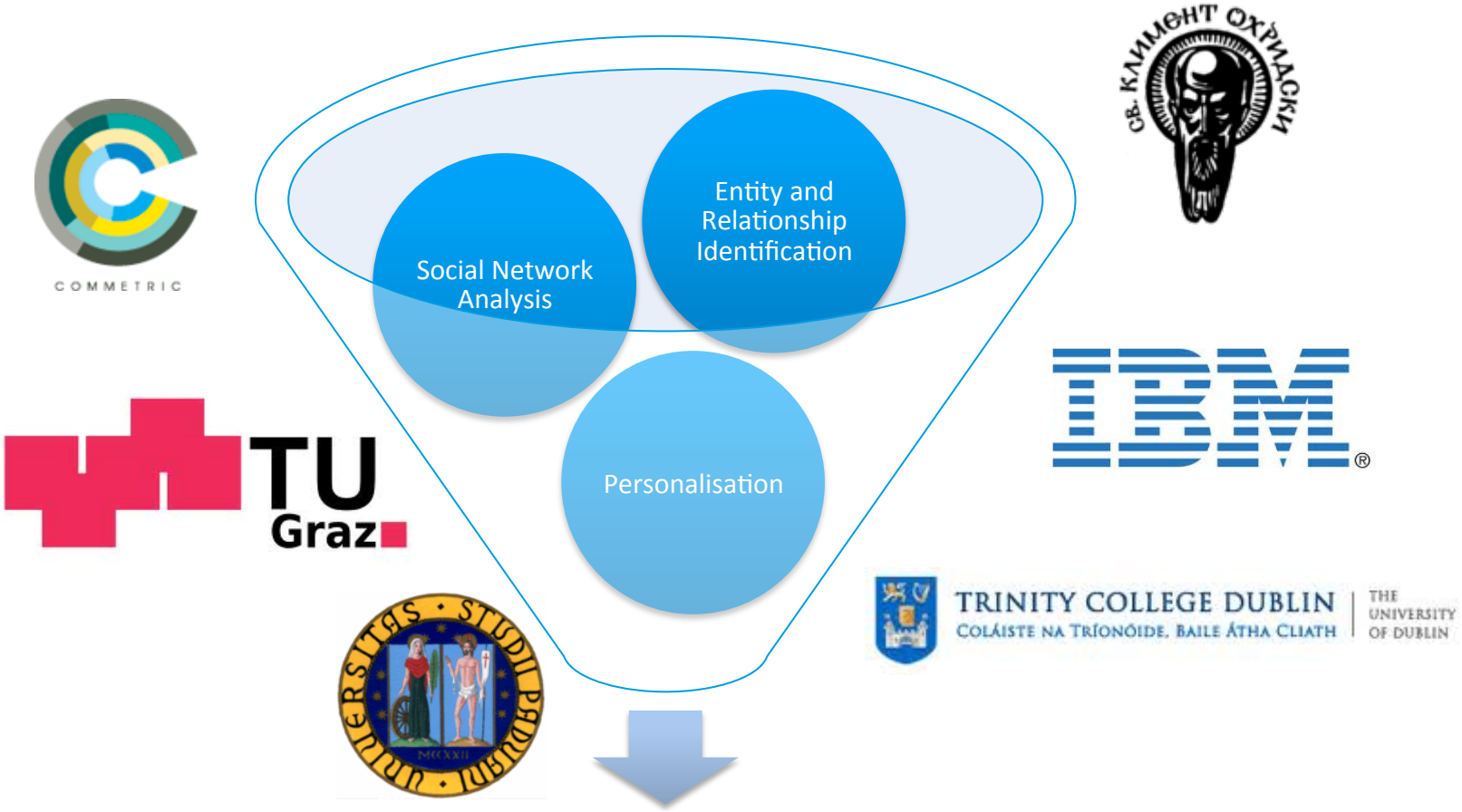
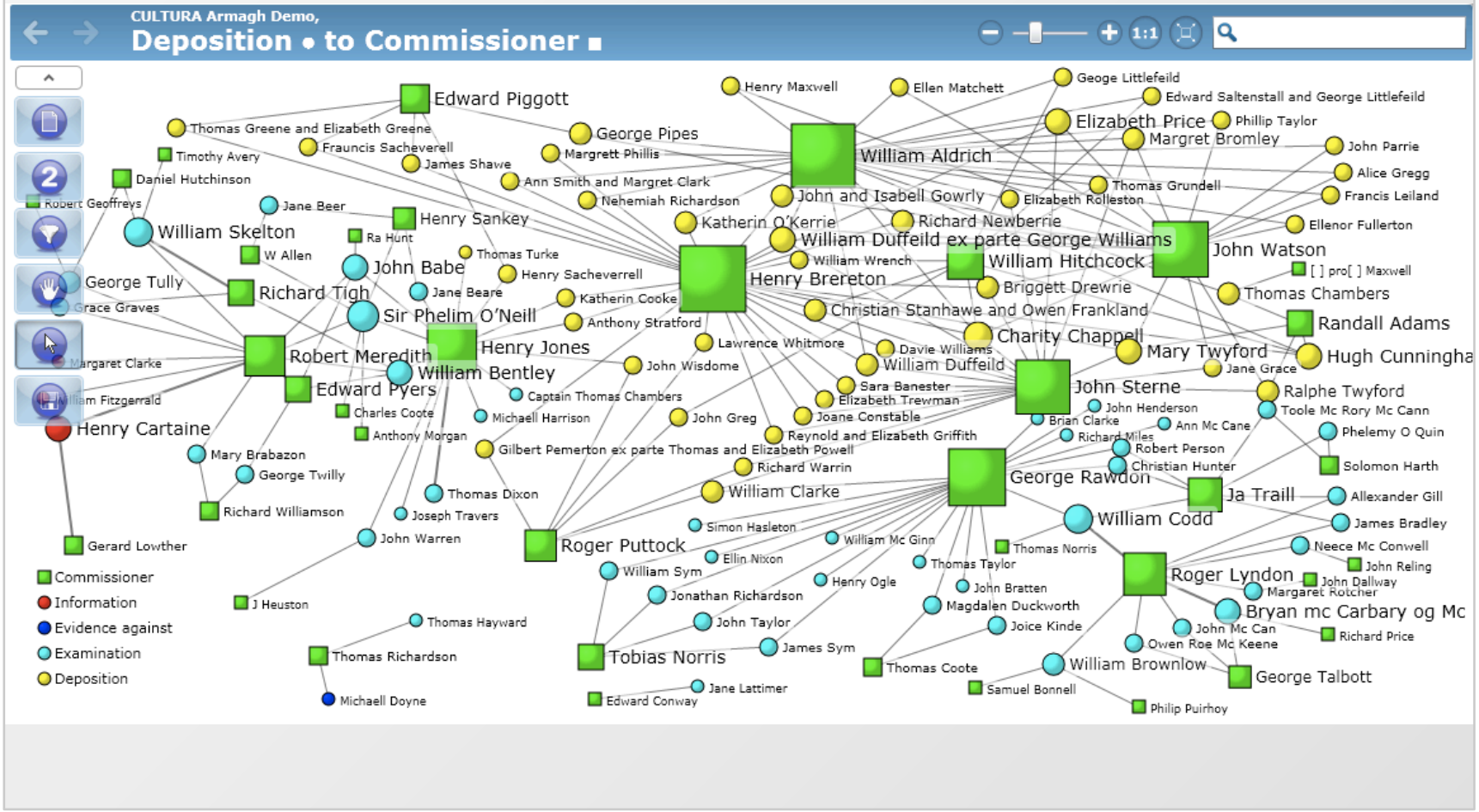
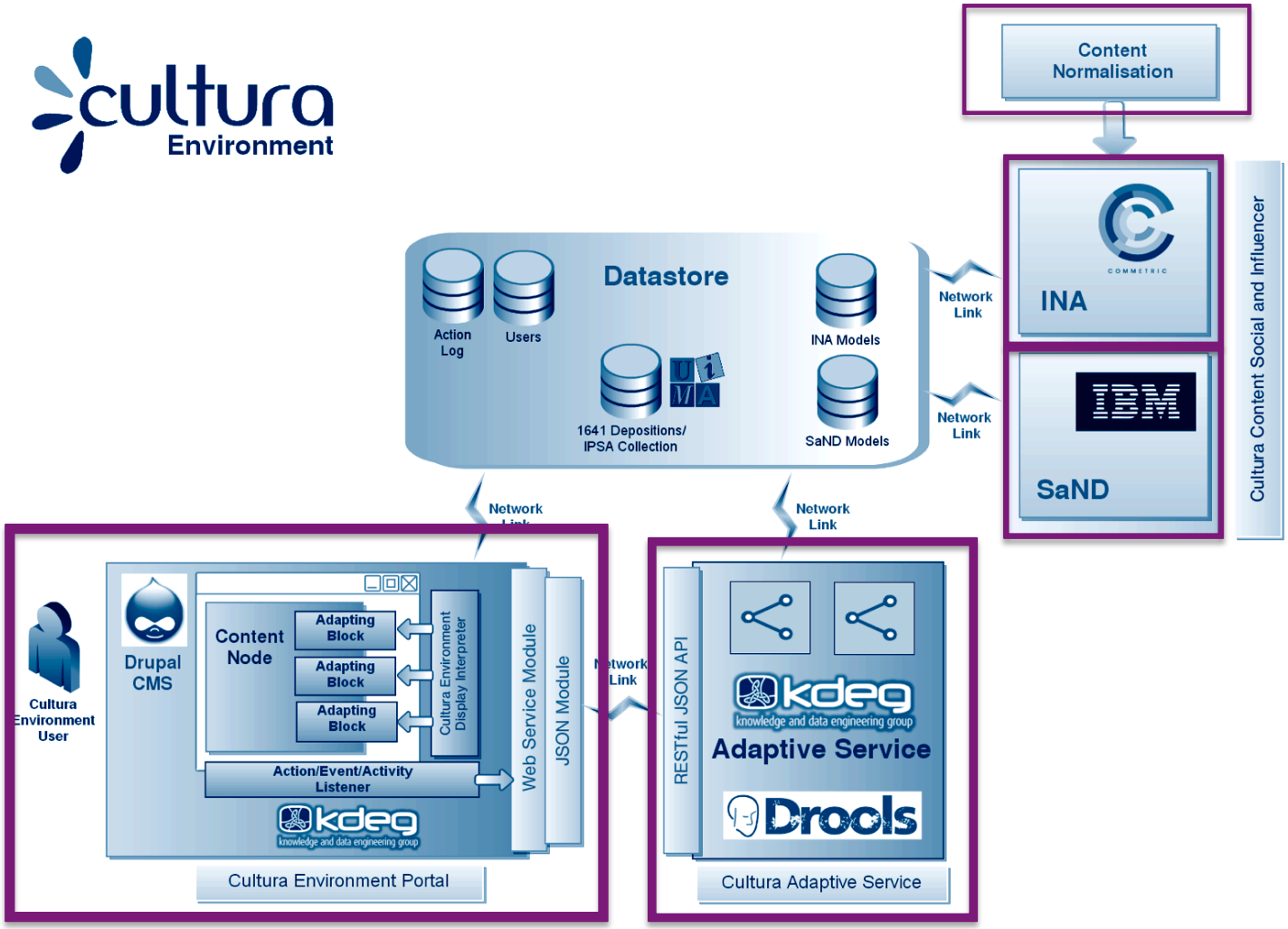


CULTURA Environment

Social Network Analysis



cultura
Environment



Baseline System

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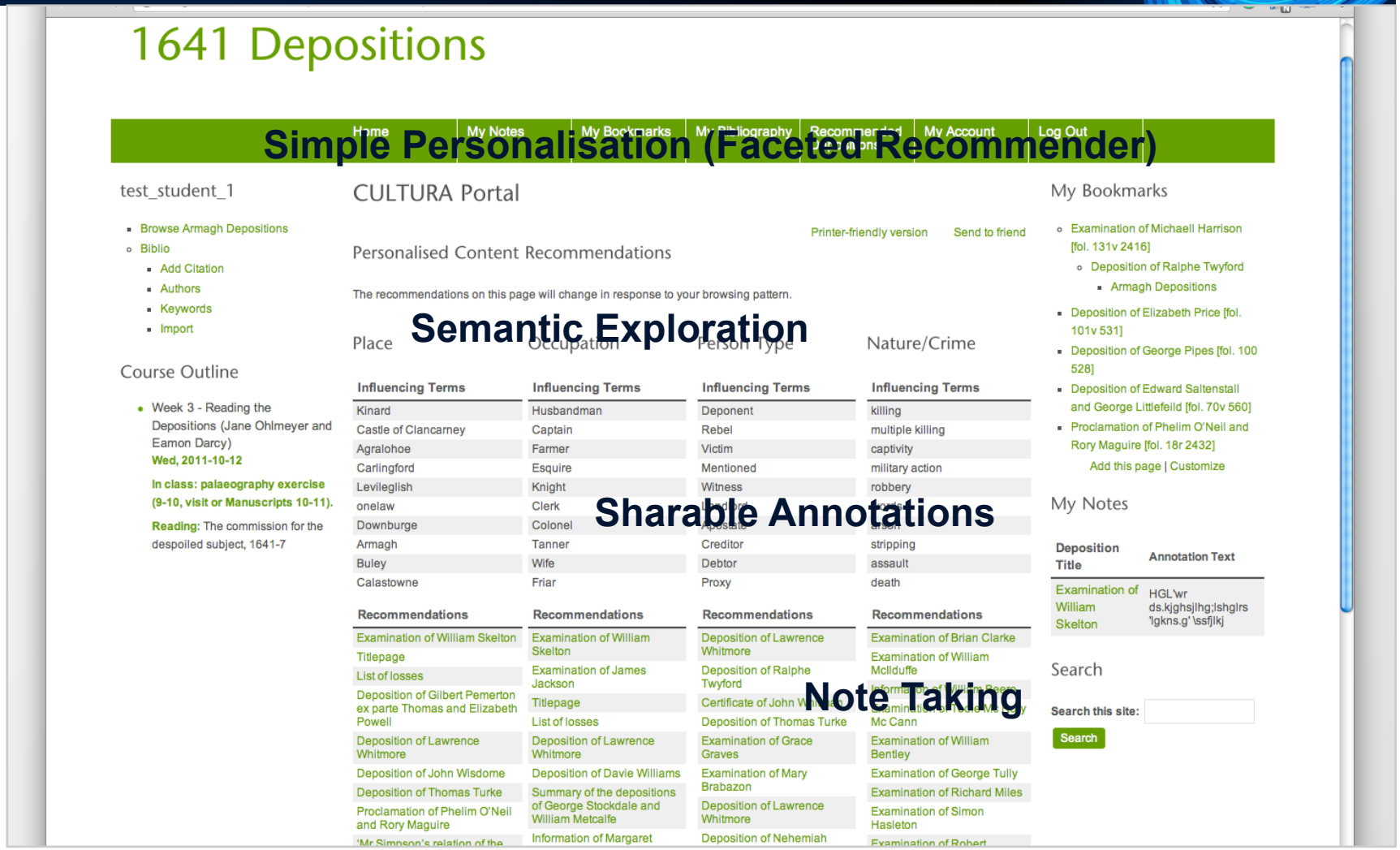

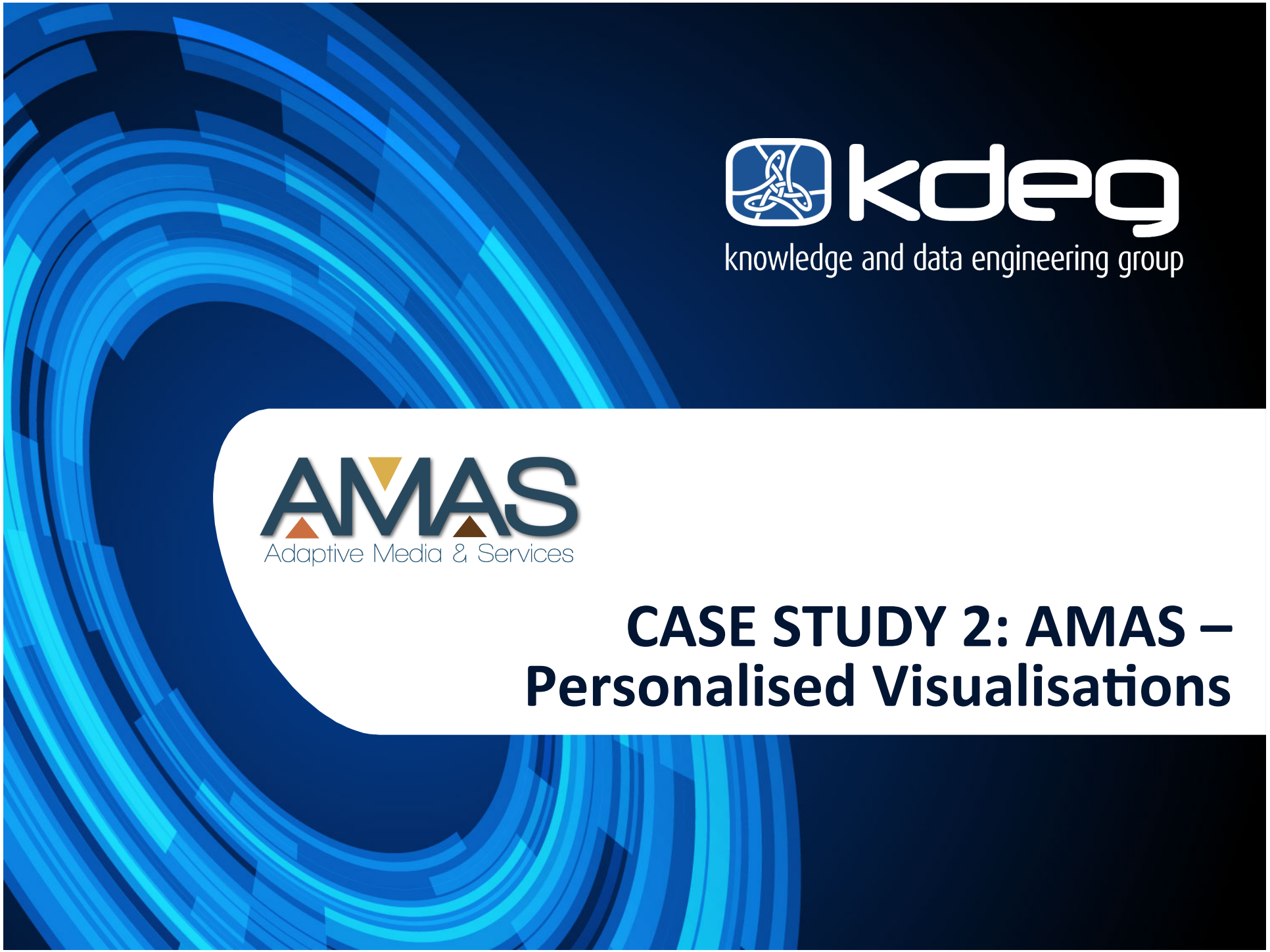
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Adaptive Media & Services
CASE STUDY 2: AMAS –
Personalised Visualisations

Adaptive Media and Services (AMAS)

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- Mission: Researching technology to empower users in adapting and repurposing web based multimedia content and web services to achieve personalised activities and tasks.

- Objectives are to research and develop

i. an architecture and models for personalised and adaptive media and services

ii. tools to enable integration of personalisation and facilitate reuse of resources and services

iii. tools and techniques to capture usage and potential reuse

iv. tools to support the visual exploration of media and services, usage data and user performance data

v. and validate the personalisation and reuse technology within authentic application settings involving rich media and web services

Motivation

- Problem
  - Large volumes of distributed heterogeneous data

    Learning Management Systems; Adaptive Systems; Assessments; User-generated

  - Inconsistent granularity and focuses of data

  - How can we support end users in consuming and exploring this data?

Objective and Challenges

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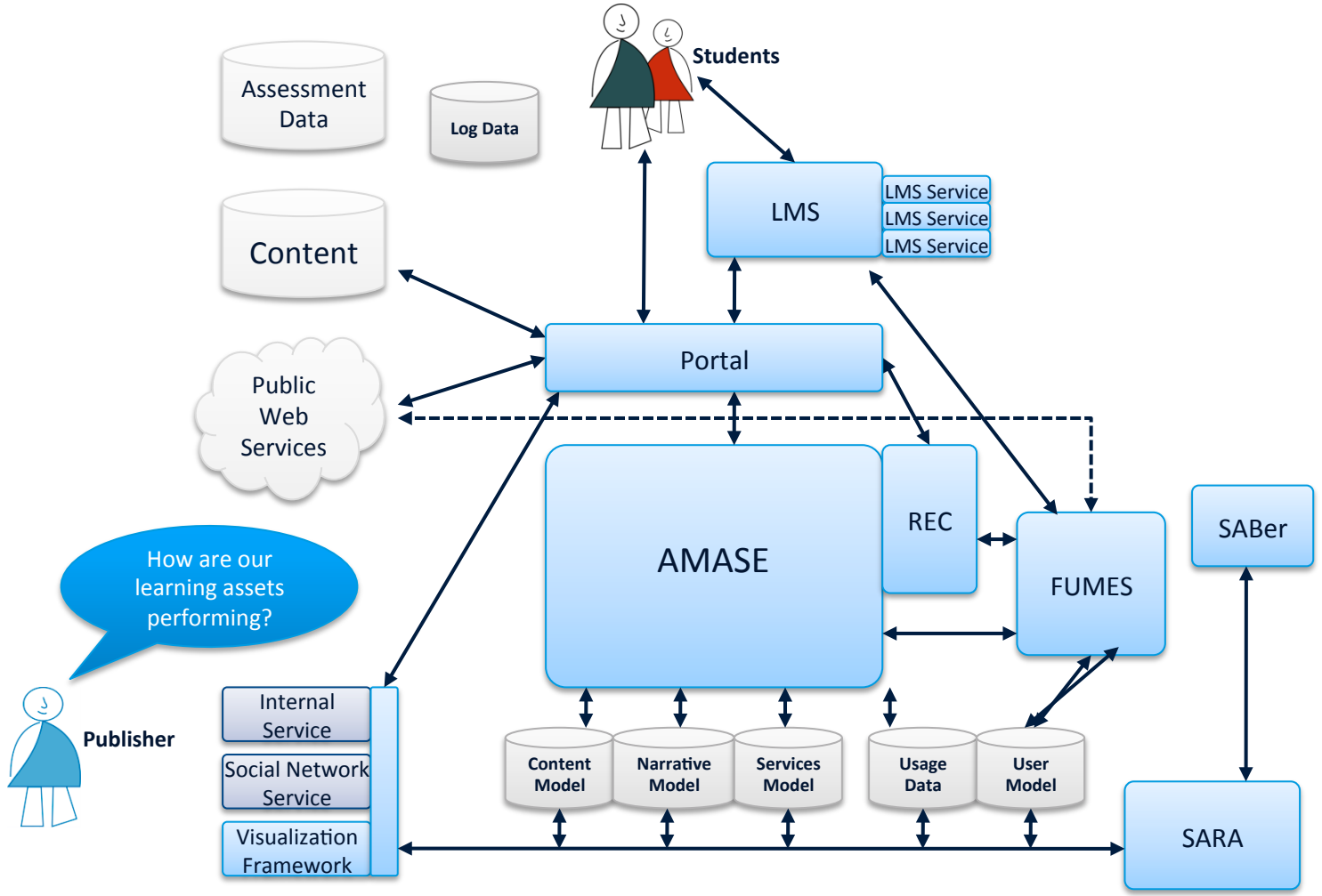
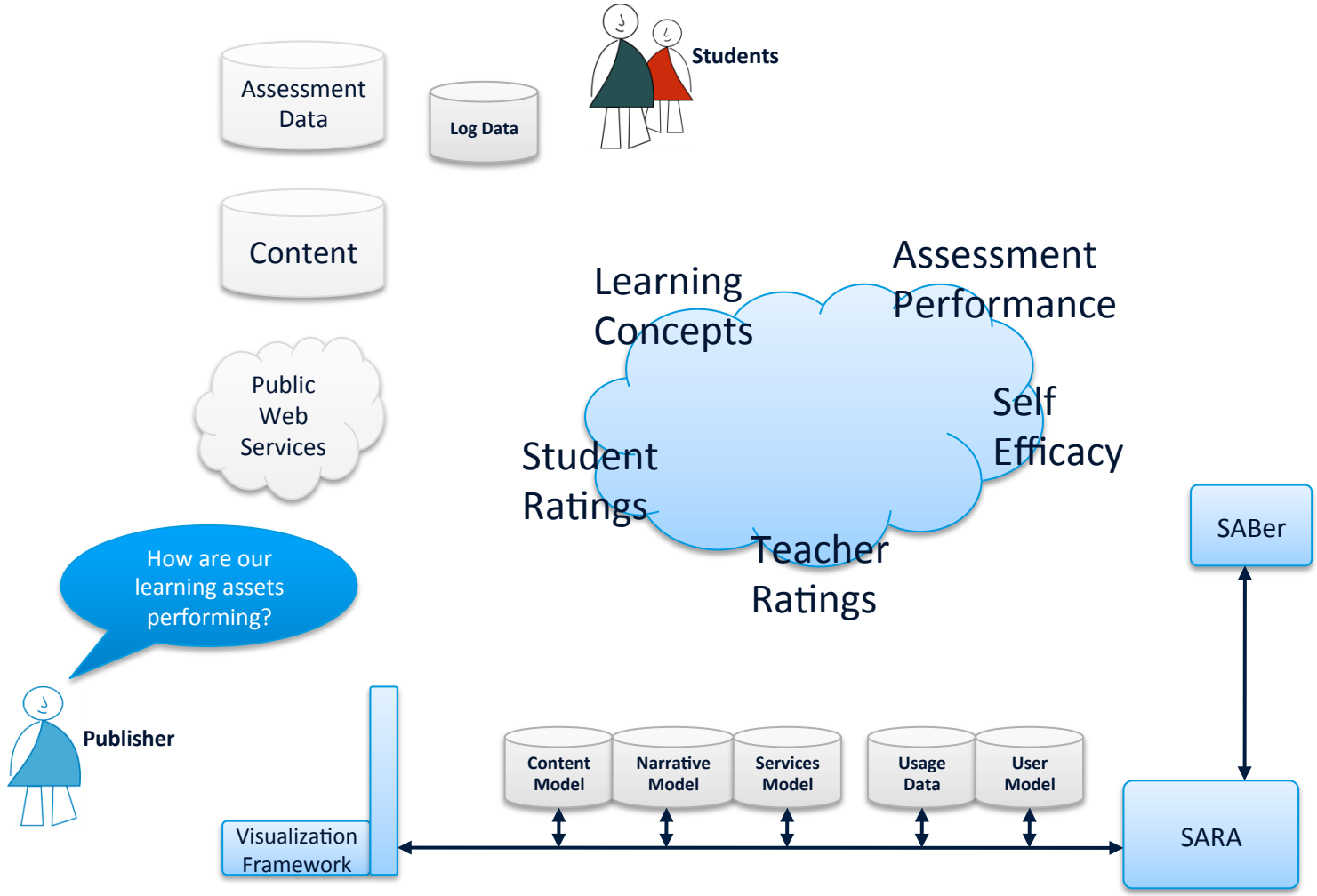
- Main Objective
  - To offer stakeholders tools to visually explore tailored views of such heterogeneous and inconsistent data.

- Two Key Challenges
  1. *personalised semantic manipulation and abstraction*
  2. *personalised information visualisation*

Use Case – Publisher



Use Case – Publisher



AMAS – Personlaised Visualisation Simplified Architecture

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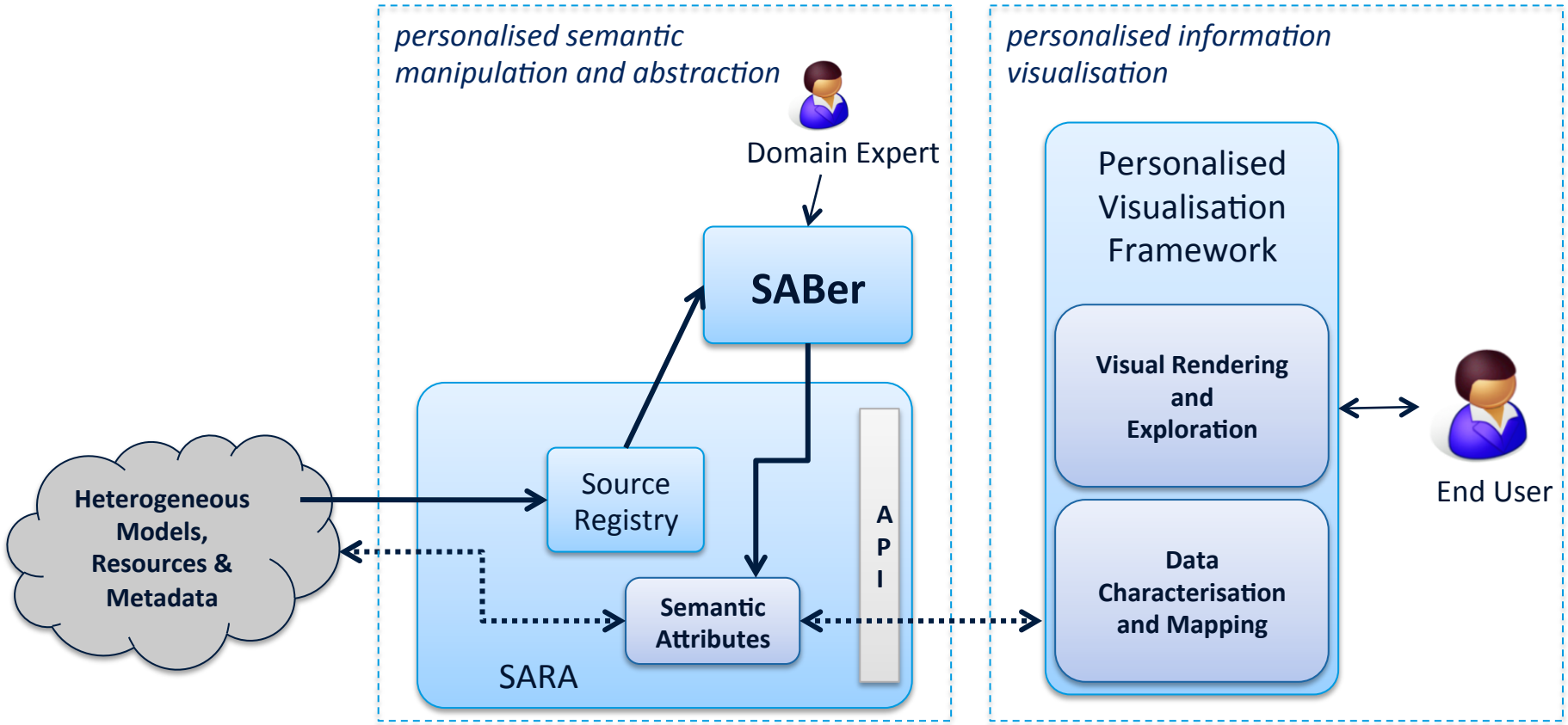
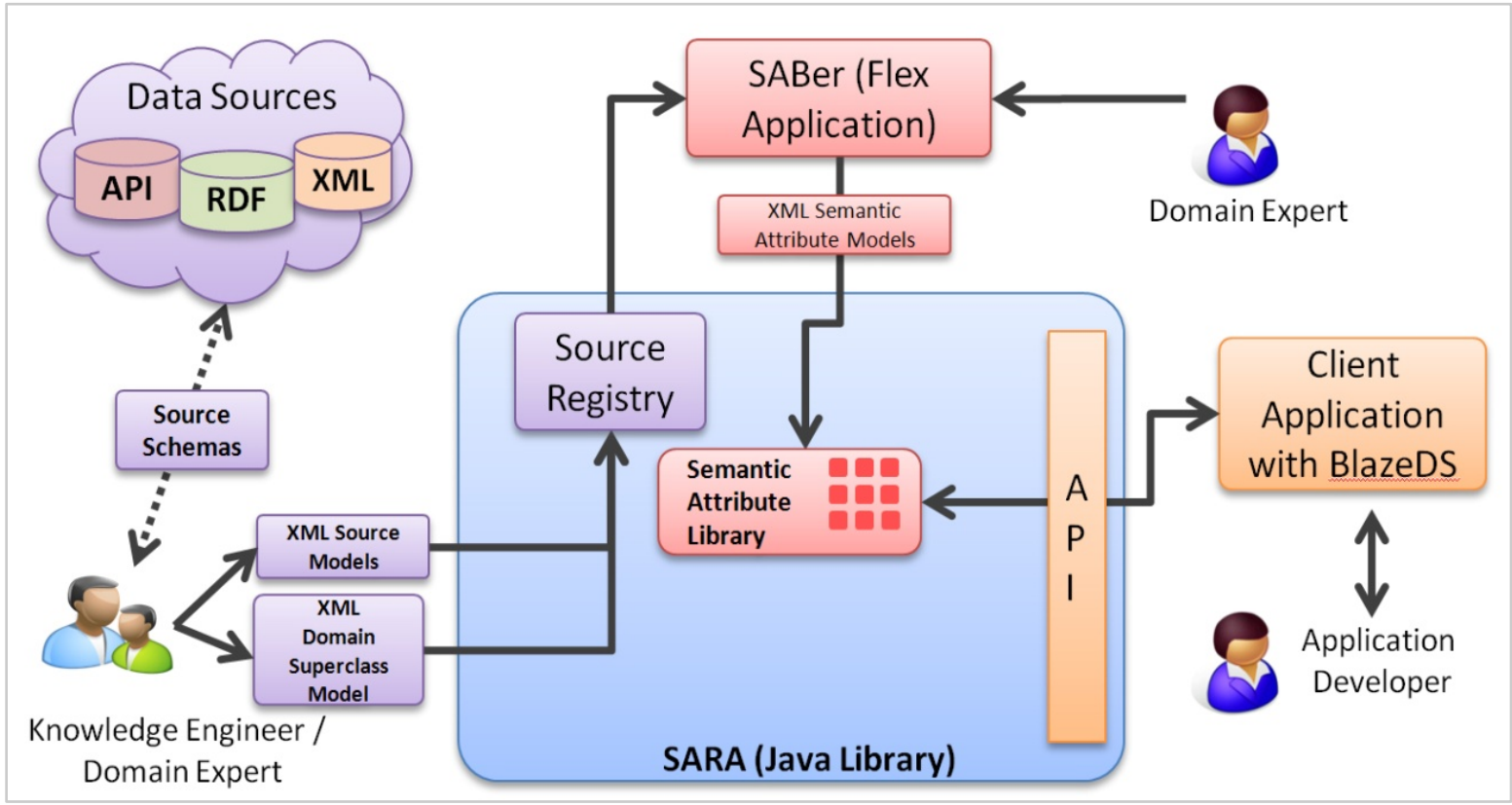


Personalised Semantic Manipulation and Abstraction

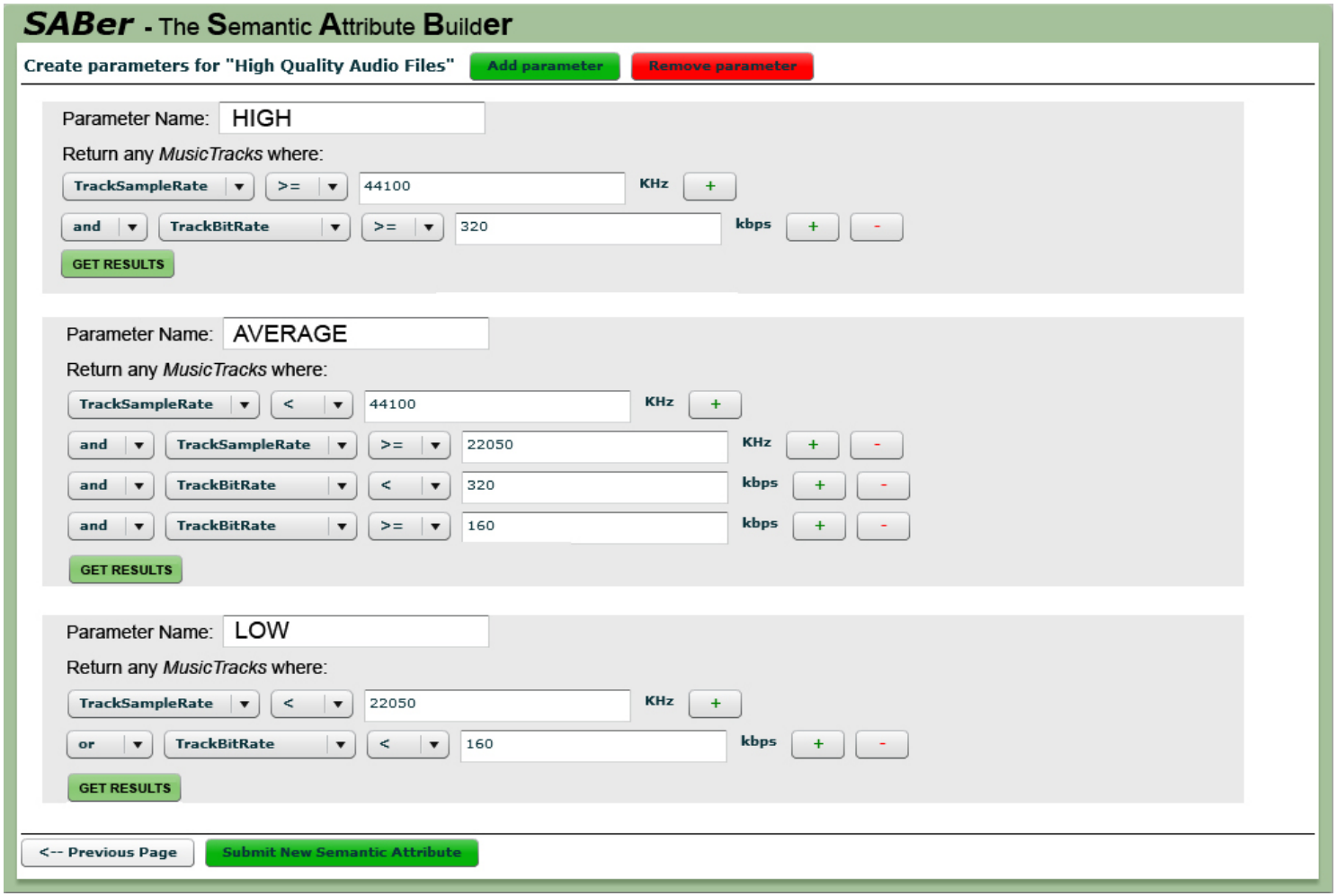
- Challenge
  - How can Subject Matter Expertise (SME) be effectively encoded by non-technical experts and then leveraged by casual users to assist exploration and querying of multiple data sources from a domain?

- AMAS has produced an *Approach for Expert-supported Semantic Uplift*, *SABer*, *SARA*

SARA Design Time Architecture



SABer – Screenshot



Client Applications

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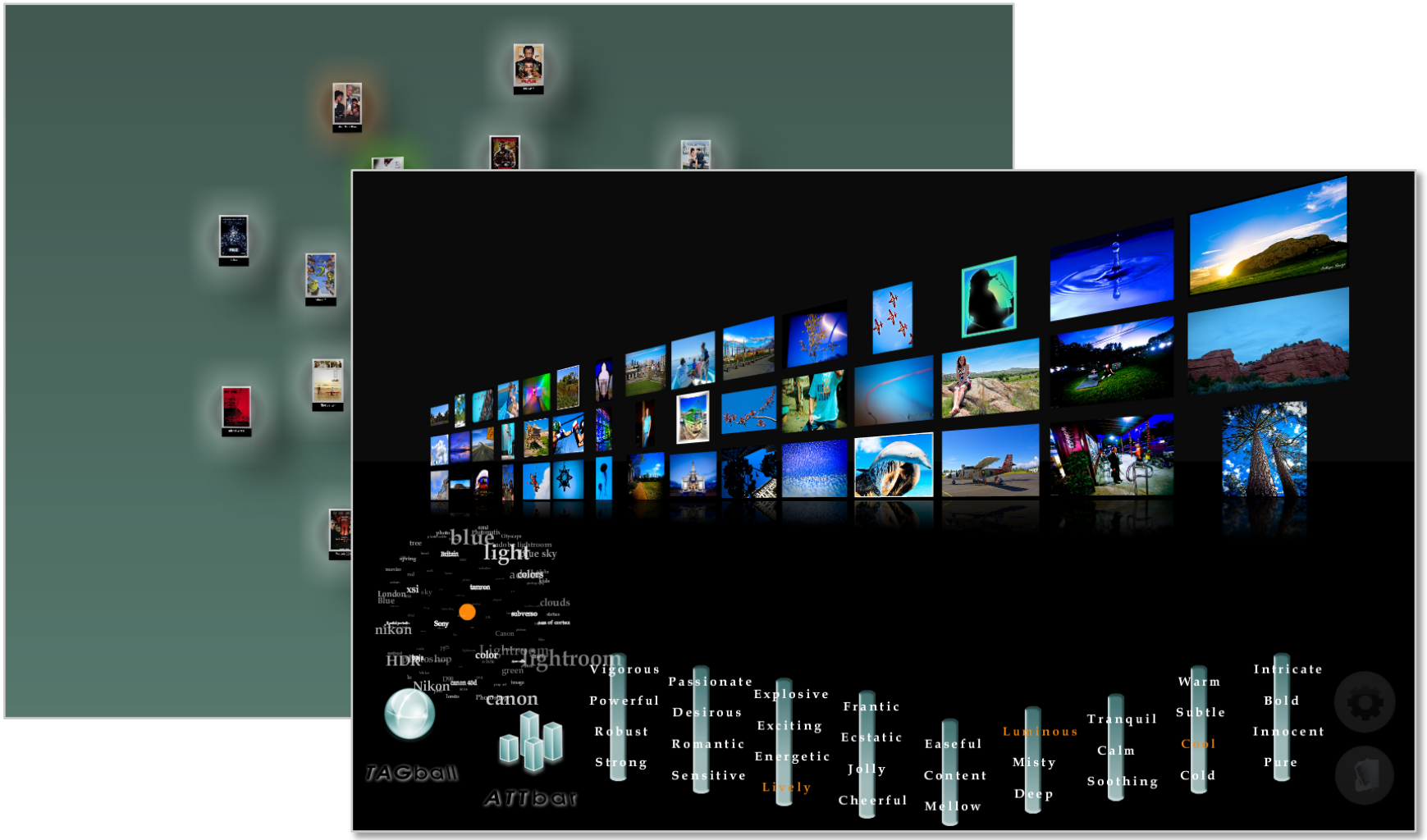

Personalised Visualisation Framework

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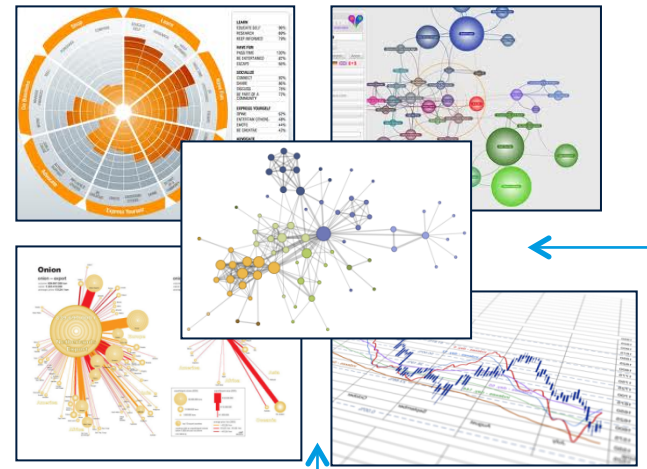
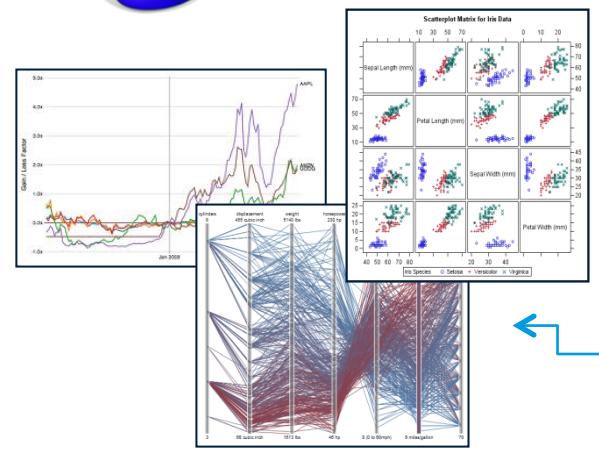
- Challenge
  - To what extent can non-expert end users be supported in navigating through and exploring across multiple visualisations (showing heterogeneous data) that have been selected to meet their individual needs?

Personalised Information Visualisation Framework

kdeg
knowledge and data engineering group





Domain Expert

Data Sources

Visual Rendering and Exploration

Data Characterisation and Mapping

SARA

Personalisation Engine

Personalised Visualisation Framework

End User

Discovery & Exploration

End User

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Conclusion

- What is Personalisation?
- What is Adaptive Hypermedia/ Adaptive Web?
  - Dimensions of Personalisation
  - Techniques for Adapting Content
  - Approaches to User Modelling
- History and Evolution of Adaptive Hypermedia
- Case Studies
  - CULTURA – Personalisation for Cultural Heritage
  - AMAS – Personalised Visualisations

Thank You!

http://www.cultura-strep.eu/
http://www.cngl.ie
http://kdeg.cs.tcd.ie/amas

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