Building Successful Open edX Instructors from Non-Faculty Domain Experts

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Open edX Conference

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LINCOLN LABORATORY
MASSACHUSETTS INSTITUTE OF TECHNOLOGY

Goal

Mentor and develop practicing engineers and scientists,

while fulfilling program missions

with short time horizons.

Outline

- **Course Creation Challenges**
- **Case Study**
- **Lessons Learned**

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Introduction to MIT Lincoln Laboratory

Established 1951

Massachusetts Institute of Technology

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Cambridge, MA

Lexington, MA

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Academic

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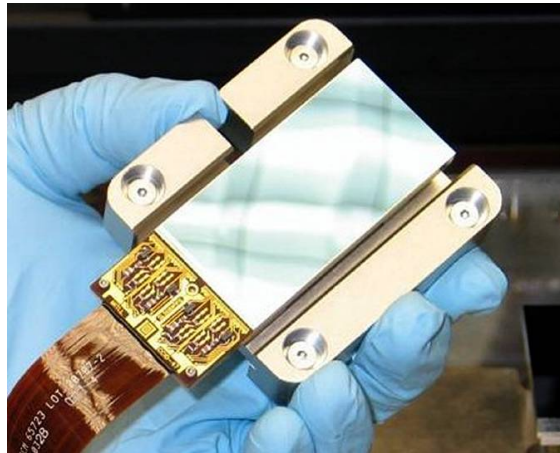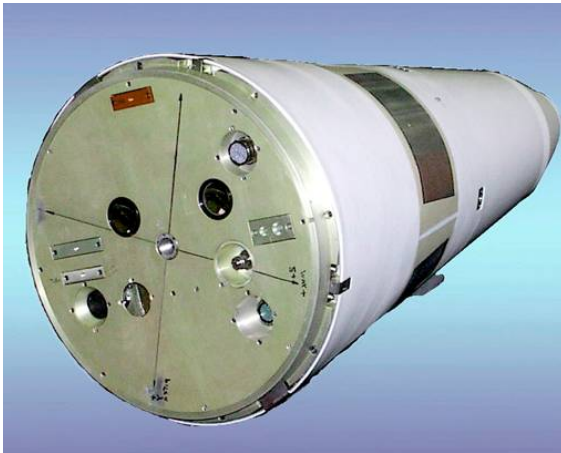
DoD Sponsored Federally Funded Research and Development Center (FFRDC), operated by MIT
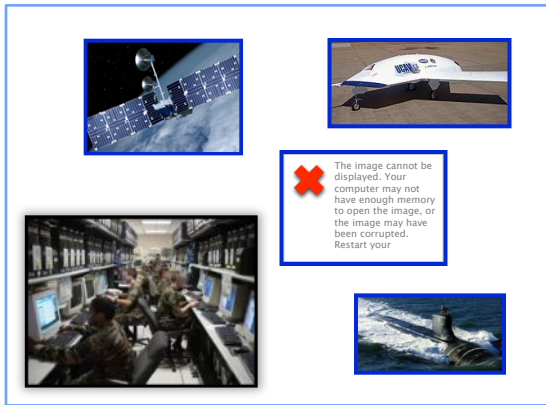
Between Academia and Industry
Putting Ideas to Work Building Prototypes

- Opportunities to work on the **realization** of the research

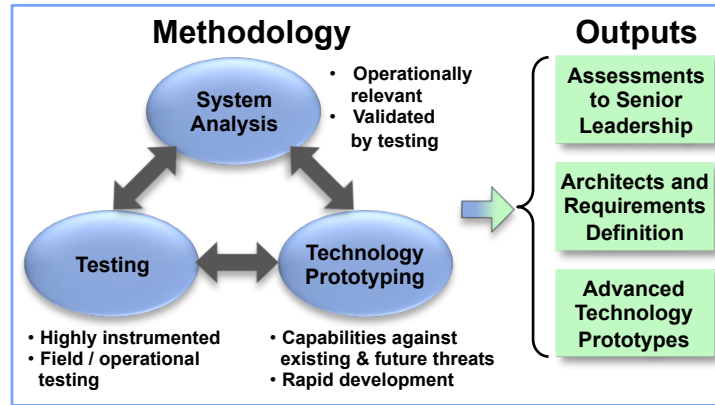- "Building and testing **prototypes** distinguishes MIT Lincoln Laboratory from academia…."

Between Academia and Industry
Supporting National Centers of Excellence

Multi-Missions

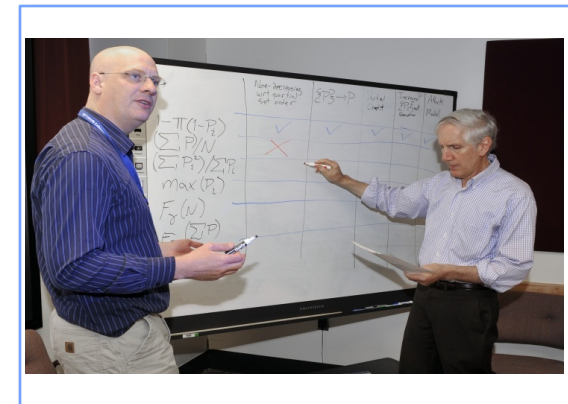## Architecture Analysis thru Detailed Design

Methodology

- System Analysis
- Testing
- Technology Prototyping

- Operationally relevant
- Validated by testing

- Highly instrumented
- Field / operational testing

- Capabilities against existing & future threats
- Rapid development

Outputs

- Assessments to Senior Leadership
- Architects and Requirements Definition
- Advanced Technology Prototypes

Rapid Prototyping

National Level Conferences and Workshops

University Affiliations

Trusted Government Advisor

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Instructor Distinctions: Professional Roles

Technical Staff

- Staff Roles
  - Applied Research:
    - Creating solutions to National Problems
    - Dissemination of knowledge via publications and conferences
  - Briefing government leaders on technology challenges and solutions
  - Mentoring colleagues in the process of achieving project goals
- Staff degrees a mix of BS, MS and Ph.D

Instructor Distinctions: Professional Roles

Faculty

- Faculty Roles
  - Teaching
  - Research:
    - Creation of new knowledge via research and scholarship
    - Dissemination of knowledge via publications
  - Mentoring graduate students
  - Community service to institution
- Faculty generally hold Ph.D degrees

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Instructor Distinctions: Teaching Experience

Faculty

- Student interaction
  - 1-to-many (courses/classroom)
  - 1-to-1 (academic advisor)
- Courses are generally in sequence with pre-requisites
- Course material is standard
  - Develop intuitive feel for where students get confused and lost
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  - Course is creation of content library
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Same goal, different starting points.

Student Distinctions

Academic

- Undergraduate Students
  - Young adults
  - Full time
  - Building understanding of specific or inter-related domain, but focus on a single domain
- Graduate Students
  - Full or part time
  - Focus on deeper learning of disciple
  - Course of studies may or may not align with current job roles
- Generally degree driven

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Professional

- Students
  - Working professionals, civilian, government and military
  - Part time, short sequences
  - Knowledge requirements
    - Refresher
    - Filling gaps in existing knowledge base
    - Extend or deepen understanding of a subject area
- Driven by
  - Need for knowledge to complete job assignment
  - Certification requirements
  - Personal interest

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Course Design

Challenges

- Brief vs teach = tell vs show
  - Instructors have minimal experience in course design
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  - Presenter is asked questions, faculty intersperse lecture with questions
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Strategies

- Shift Instructor focus
    - From "what am I telling the audience" to "what do they need to understand to be successful"
    - Actively consider how to gauge student level of understanding
- New focus affects
    - Selection of content
    - Granularity of content
    - Method of delivery
    - Development of assessments
    - Interactions with students
- Modules support broad range student backgrounds:
    - Provide necessary background
    - Skip familiar material

Course Creation

Issues For Academic and Professionals

- Content Preparation
  - Slides
  - Scripts
  - Software
  - Examples

- Lack of Experience with
  - Video Capture
  - Microphone use
  - Tablets use for derivations

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Strategy

Training!

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- **Lessons Learned**

Case Study: Evolution of Advanced Database Technology Course

Advanced Database Technologies – January 2014

Day 1 Systems Thinking	Day 2 Optimization with	Day 3 Fusion with
	accumulo · sqrrl	SciDB · paradigm4

Part 1: Agenda

Day 1

- Roughly broken into 3 parts:
  - Part 1: Introduction to Big Data and Cloud Computing
  - Part 2: Database Technologies
  - Part 3: Introduction to Apache Accumulo
- Hands on-exercises in Day 2 will reinforce the concepts taught

Course Goal:
To give you the knowledge needed to effectively use Apache Accumulo and knowledge about other DB technologies

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TODAY'S AGENDA

GOALS OF OVERVIEW

- Understand Accumulo design goals & fundamentals
- Introduction to using Accumulo
  - Data model
  - Client API
  - Indexing strategies

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Agenda

Plan for Today

- Learning:
  - SciDB configuration
  - Data model and query language
  - Example computations
  - SciDB-R, UD*
- Datasets:
  - NASA Modis
    - From http://modis.gsfc.nasa.gov/
    - MODBASE
  - POI California
    - From USGS

Copyright © Paradigm4 Inc. 2013 All Rights Reserved.   4   SciDB · paradigm4

Traditional Workshop Format
- **Content**
  - **Delivered via slides and lectures**
  - **Mixture of theory, training instruction and vendor marketing information**
- **Hands-on Examples worked in teams**

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Case Study: Evolution of Advanced Database Technology Course

Advanced Database Technologies – January 2014

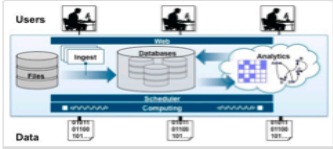| Day 1 Systems Thinking	Day 2 Optimization with	Day 3 Fusion with
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Advanced Accumulo Design – August 2014

Day 1 Systems Thinking	Day 2 Optimization with accumulo

Internal Course Offering Over 2 Half Days
- **Content**
  - **Delivered via slides and lectures**
  - **Mixture of theory and training instruction**
  - **Natural breaks were built into slides via questions – simulating faculty in classroom**
- **Hands-on Examples worked in teams**

Case Study: Evolution of Advanced Database Technology Course

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Advanced Accumulo Design – August 2014

Day 1 Systems Thinking	Day 2 Optimization with accumulo

MOOC Offering – 2015

LLX   Course Started - May 03, 2015 at 23:00 UTC

LLX02 Advanced Database Technologies

View Course

Unenroll

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Computer Science Discovery Course
Design for open edX platform

Step 1. Review the course and extract essential questions

Data Challenge	**System Challenge**	**Analyst Challenge**	**Putting it together**
What am I working with?	**What tools should I use?**	**How should I proceed?**	**How do I integrate it?**

Step 2. Use questions to define broad themes and select concepts to include in course

Step 3. Connected the concepts into coherent learning modules, aka content map or visual syllabus

Step 4. Used content map to create course outline
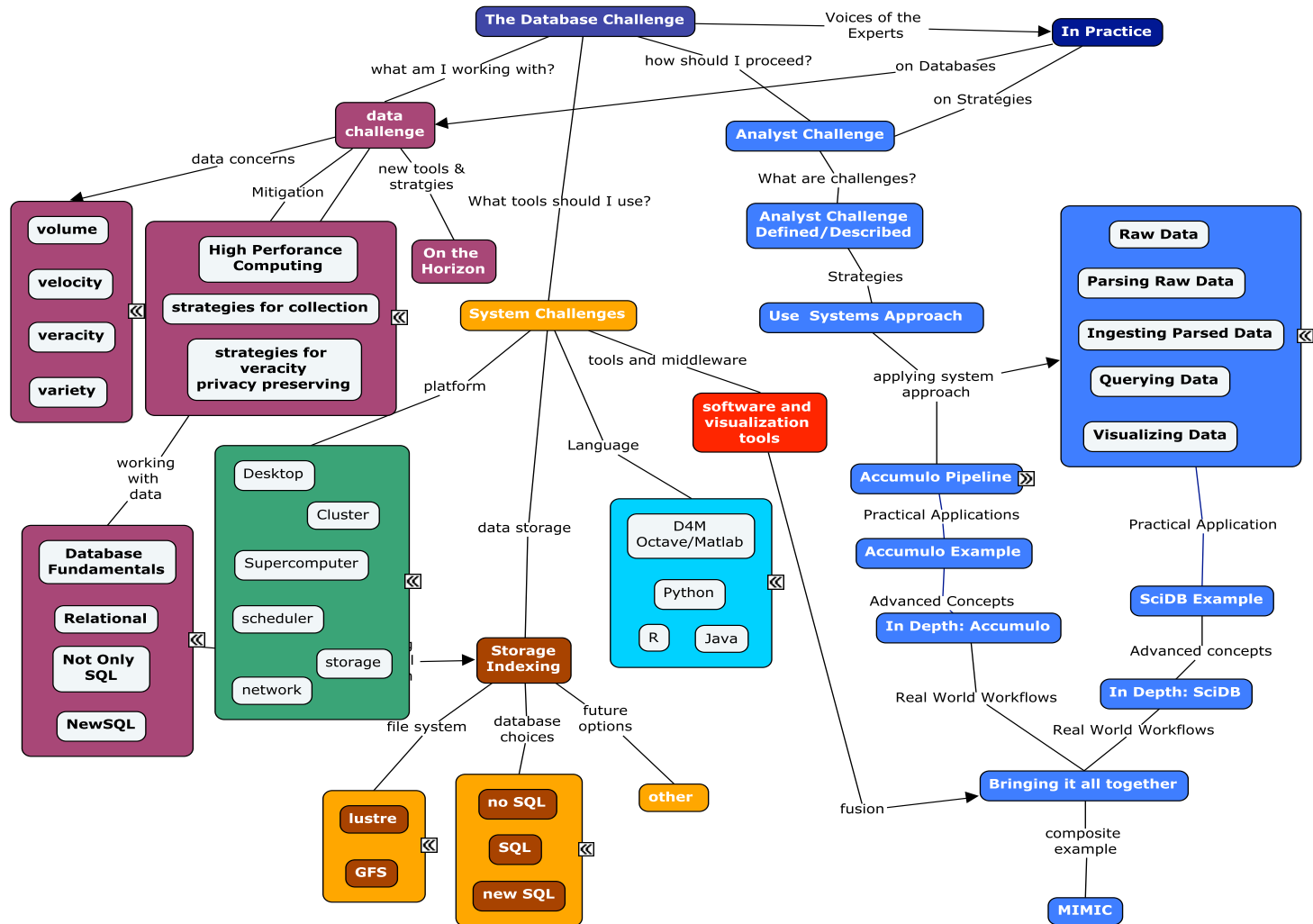
Connecting Content Map to Open edX Course
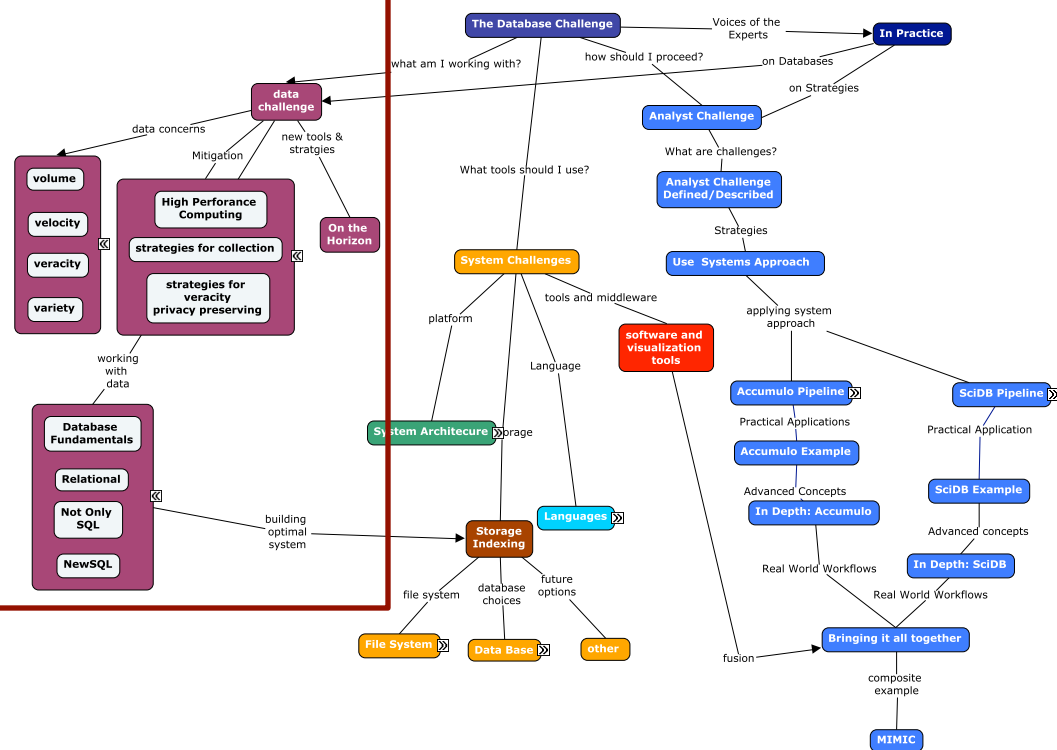
Advanced Database Technologies
Traditional Syllabus

- ◆ **Welcome**
  - ○ **Course Overview and Goals**
  - ○ **Meet the Instructors**
- ◆ **The Data Challenge**
  - ○ **Challenge Overview**
    - ✓ **Challenge of Data Volume**
    - ✓ **Challenge of Data Velocity**
    - ✓ **Challenge of Data Veracity**
    - ✓ **Challenge of Data Variety**
    - ✓ **Challenge Review**
  - ○ **General Strategies**
    - ✓ **High Performance Computing**
    - ✓ **Strategies for Collection**
    - ✓ **Strategies for Privacy Preserving**
  - ○ **Database Landscape**
    - ✓ **Database Fundamentals**
    - ✓ **SQL**
    - ✓ **NoSQL**
    - ✓ **NewSQL**
    - ✓ **Database Trade-offs Summary**
  - ○ **On the Horizon**

- ◆ **The System Challenge**
  - ○ **System Architecture**
  - ○ **Database Architecture**
  - ○ **Language Overview**
  - ○ **D4M**
- ◆ **The Analyst Challenge**
  - ○ **Introduction**
  - ○ **Accumulo Pipeline**
  - ○ **Accumulo Example**
  - ○ **In Depth: Accumulo**
  - ○ **SciDB Pipeline**
  - ○ **SciDB Example**
  - ○ **In Depth:SciDB**
- ◆ **Bringing it Altogether**
  - ○ **Composite example**
- ◆ **In Practice**
  - ○ **Mike Stonebraker**
  - ○ **Sam Madden**
- ◆ **Summary**
  - ○ **Review**
  - ○ **Exam**

◆ Module ○ Section ✓ Unit

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Summary of Course Revamp

Initial Material → **Review existing material, develop concept Map** → **Sort existing material into concepts, identify gaps** → **Create new material and update existing material** → **Create Courseware**

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Lessons Learned

- **Course Design**
  - **Having existing materials doesn't necessarily mean less design work**
  - **Focus on goal: to help a student build a mental model**
  - **Reiterate "brief = tell, teach = show"**
  - **It's a Process!**
    - **Articulate the process, it makes it more accessible**
    - **Provide tangible examples of the process**
    - **Feedback from initial videos provides input into content creation and update**

- **Course Creation**
  - **Script your video**
  - **Practice your script**
    - **Writing and speaking vocabulary very different**
    - **You will identify additional gaps**
  - **Build out your slides, there is more control than with animations**
  - **Take small steps and remember…it's a process.**

Backup

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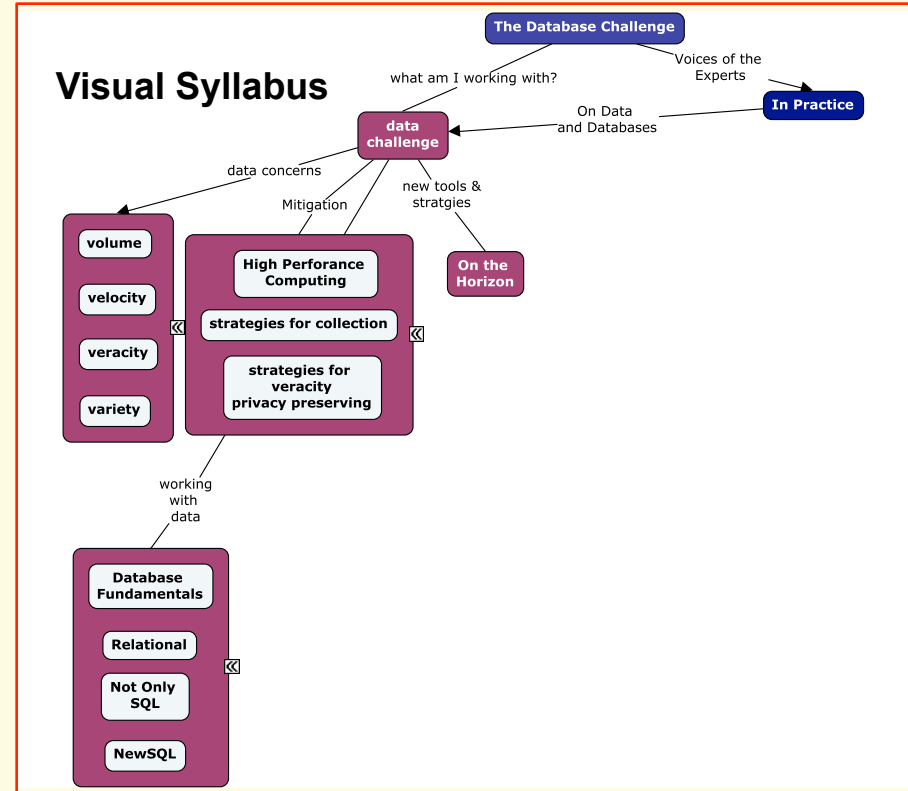 - ○ **On the Horizon**

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Visual Syllabus

Mapping concepts to Course Elements

Main concepts map to Modules
Nested Concepts Map to Sections
Leaves map to Units

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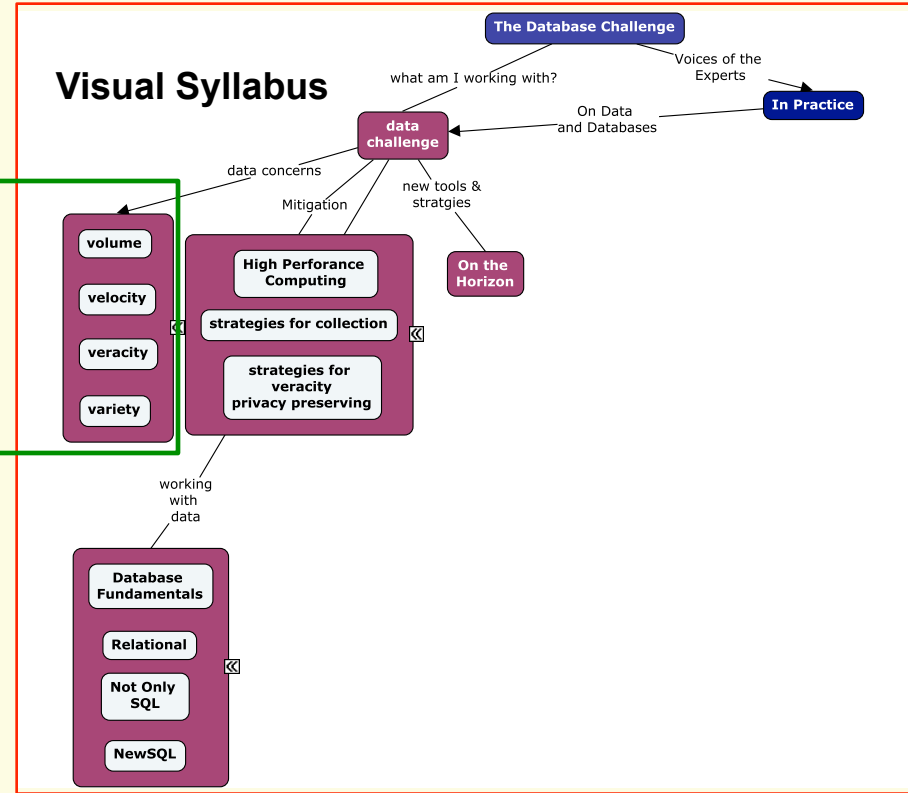   - ✓ **Strategies for Privacy Preserving**
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