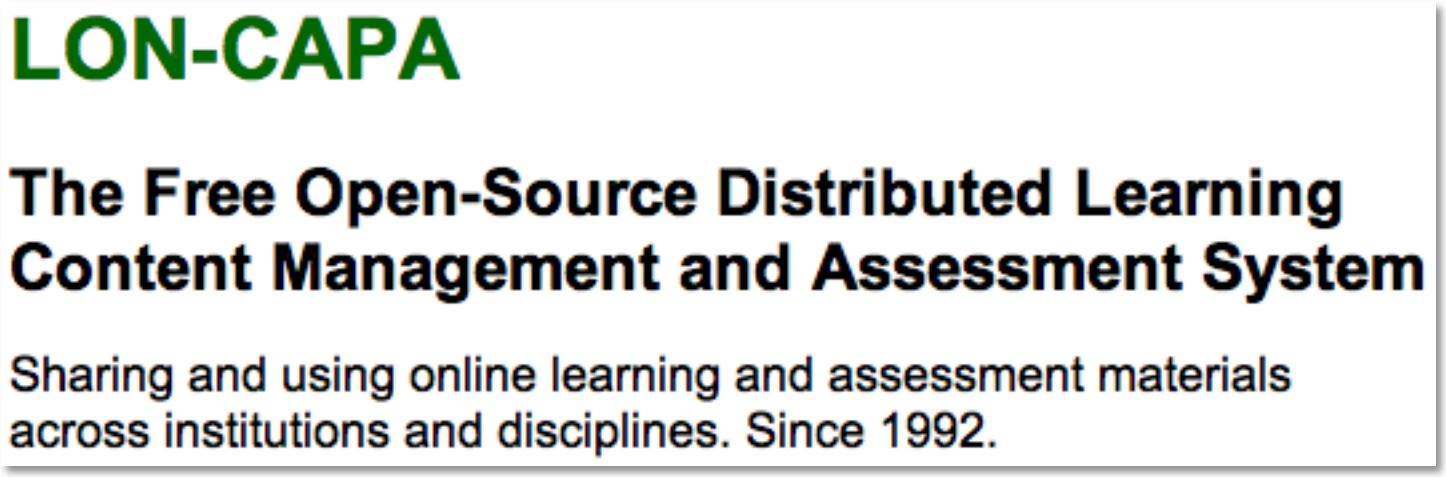
The LON-CAPA Resource Sharing Network

Gerd Kortemeyer
Michigan State University

Experiences

- The whole conference is about sharing content
- No sense preaching to the choir
- Thus:
- 

- What have we learned in 20 years?

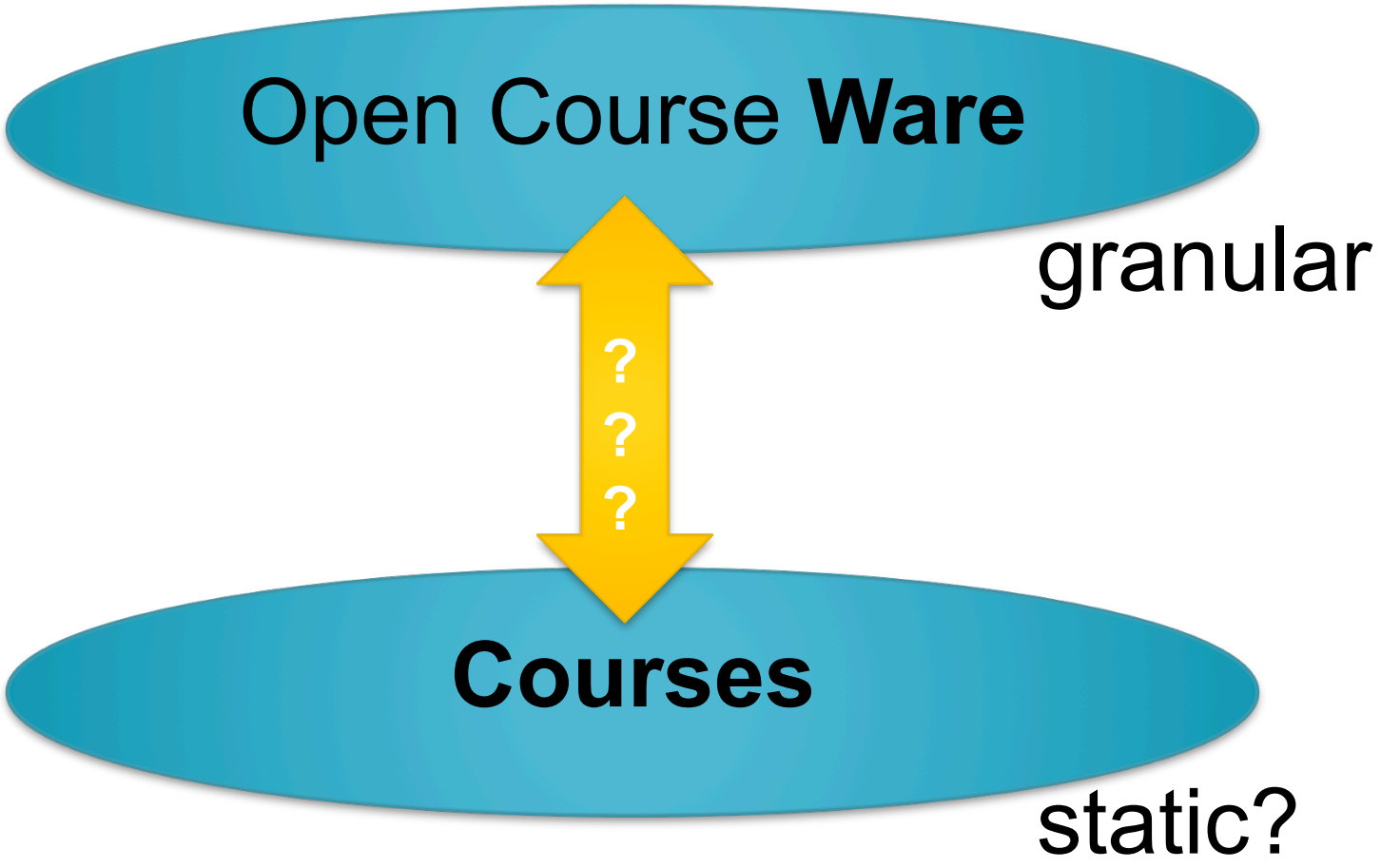
Experiences

- Focus on online educational resources for learners
  - Not on research publications
  - Not on guides on how to teach better
  - Not digital versions of books
  - Not collections of materials for lecture preparation
  - Not data collections (except for learners to evaluate as part of their learning)
- Compatible with OER idea
- LON-CAPA: usually in course-context

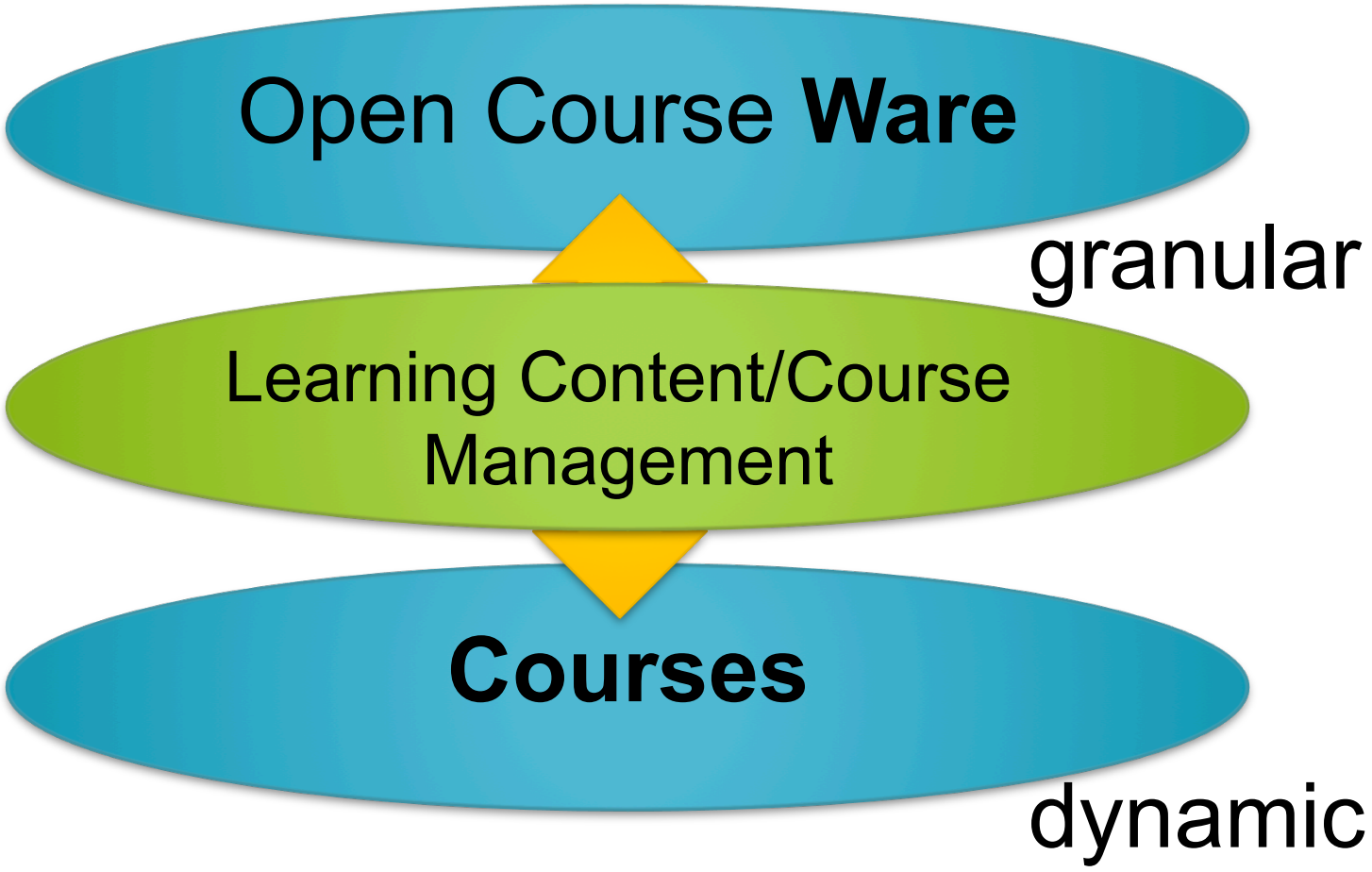
Experiences

- Focus on large enrollment introductory undergraduate courses and AP courses at schools
  - online
  - hybrid
  - online supplement or textbook replacement for traditional lectures
- New in 2012: free open course
  - 2000 students in free online physics course http://relate.mit.edu/physicscourse
- Faculty compiles content for students into courses

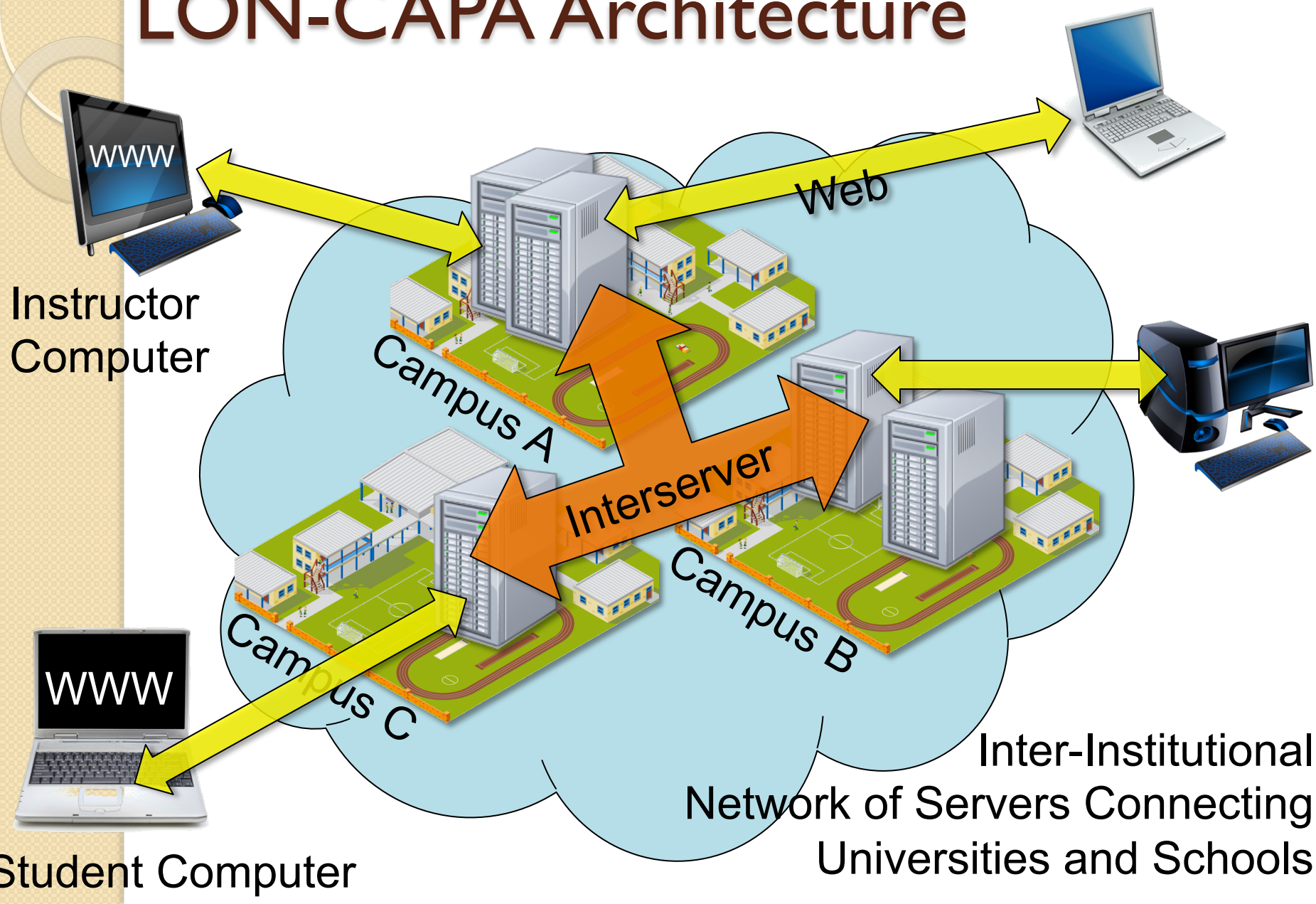
Conflict or Synergy?



Conflict or Synergy?



LON-CAPA Architecture



LON-CAPA Architecture

Course Management

Campus A

Resource Assembly

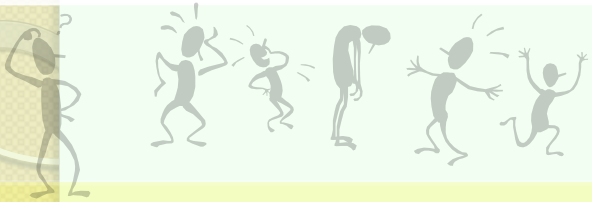
Course Management

Campus B

Resource Assembly

Shared Cross-Institutional
Digital Resource Library

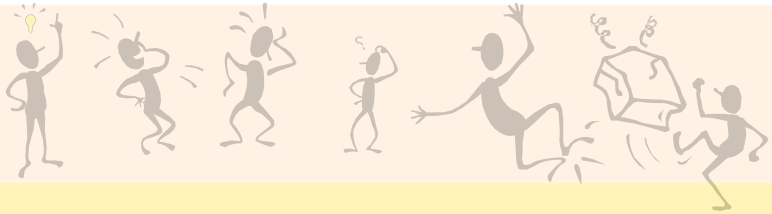
LON-CAPA Architecture



Course Management

Campus A

Resource Assembly



Course Management

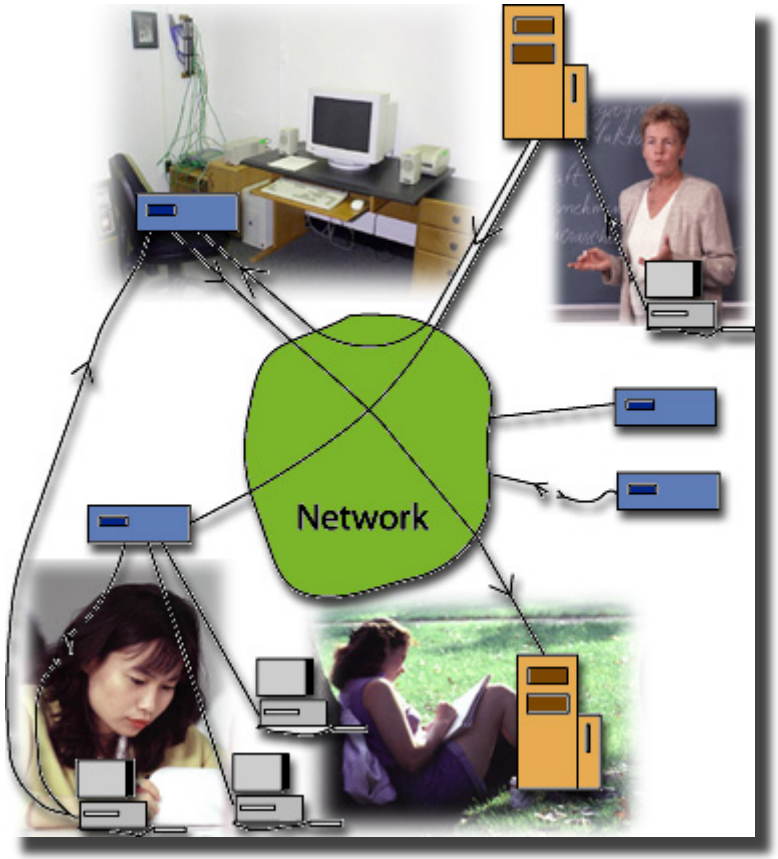
Campus B

Resource Assembly

Shared Cross-Institutional
Digital Resource Library

Shared Resource Library

- The distributed network looks like one big file system



- Domain - sc (University of South Carolina)
- Domain - sfu (Simon Fraser University)
  - batchelo
  - chem281
  - exafs
  - hanlan
  - mxchen
  - slavieri
  - vjungic
- Domain - sunysb (SUNY Stony Brook)
- Domain - tmcc (Truckee Meadows Community College)
  - jensen
  - mbauer
  - souza
    - Greenberg
      - default.sequence (metadata)
    - samples
  - testuser1
- Domain - ucf (University of Central Florida)

Shared Resource Library

- Resources may be web pages …

EXAMPLE

Example: Looping

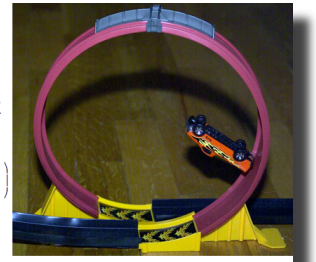
A toy car can go through a looping if it is fast enough. What are the forces that act on it? How fast does it have to be?

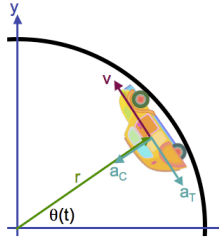
The motion is obviously circular, but non-uniform: the car will slow down on the way up, and speed up on the way down. With r being the radius of the looping, the x-axis horizontal, the y-axis pointing up, the origin being in the center of the looping, and $\theta(t)$ being the angle, the position of the car is given by

$$\vec{r}(t) = \begin{pmatrix} r\cos(\theta(t)) \\ r\sin(\theta(t)) \end{pmatrix}$$

as long as it does not fall off the track.

The figure below illustrates the setup:

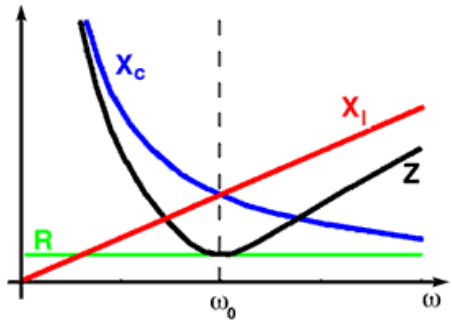




Impedance

The addition of the three currents (through the resistor, the inductance, and the capacitance), each of which is 90° out of phase with each other, in quadrature yields:

$$\begin{aligned} V &= \sqrt{V_R^2 + (V_C - V_L)^2} \\ &= \sqrt{(I\,R)^2 + (I\,X_C - I\,X_L)^2} \\ &= I\sqrt{R^2 + (X_C - X_L)^2} \\ &= I\,Z \end{aligned}$$



where I is the current, X_C and X_L are the capacitive and inductive reactances, respectively, and Z is the impedance. Putting in the values of the reactances, we obtain for Z:

$$Z = \frac{V}{I} = \sqrt{R^2 + (X_C - X_L)^2}$$

$$= \sqrt{R^2 + \left(\frac{1}{\omega C} - \omega L\right)^2}$$

$$= \sqrt{R^2 + \left(\frac{1}{2\pi f C} - 2\pi f L\right)^2}$$

nd has its minimum of Z = R when

$$\omega_0 = (LC)^{-1/2},$$

pure LC circuit. This is the resonance frequency of the RLC circuit. The dance and of the reactances is shown in the figure.

ave to be added in a special way. They end up as a single quantity Z, the alent of the resistance.

EXAMPLE

Focal Length

The following pictures are taken from the same vantage point with three different zoom lenses:

- 17mm-35mm wideangle zoom
- 24mm-70mm normal zoom
- 70mm-300mm tele zoom

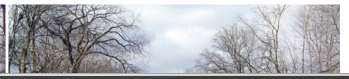
using a digital camera with an image sensor of 24mm x 36mm (standard so-called 35mm image format).

17mm extreme wide angle

24mm wide angle

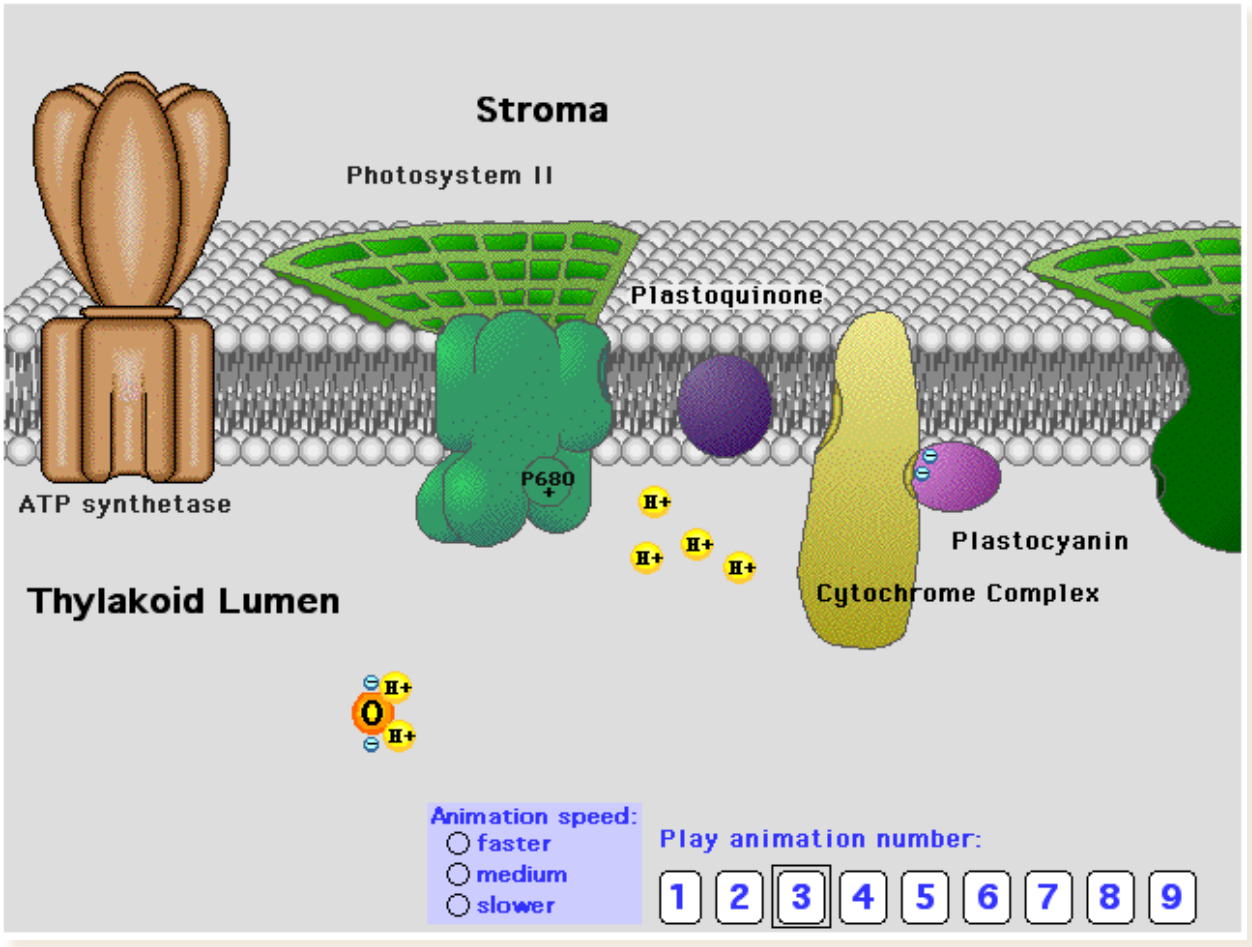
35mm mild wide angle

48mm normal



Shared Resource Library

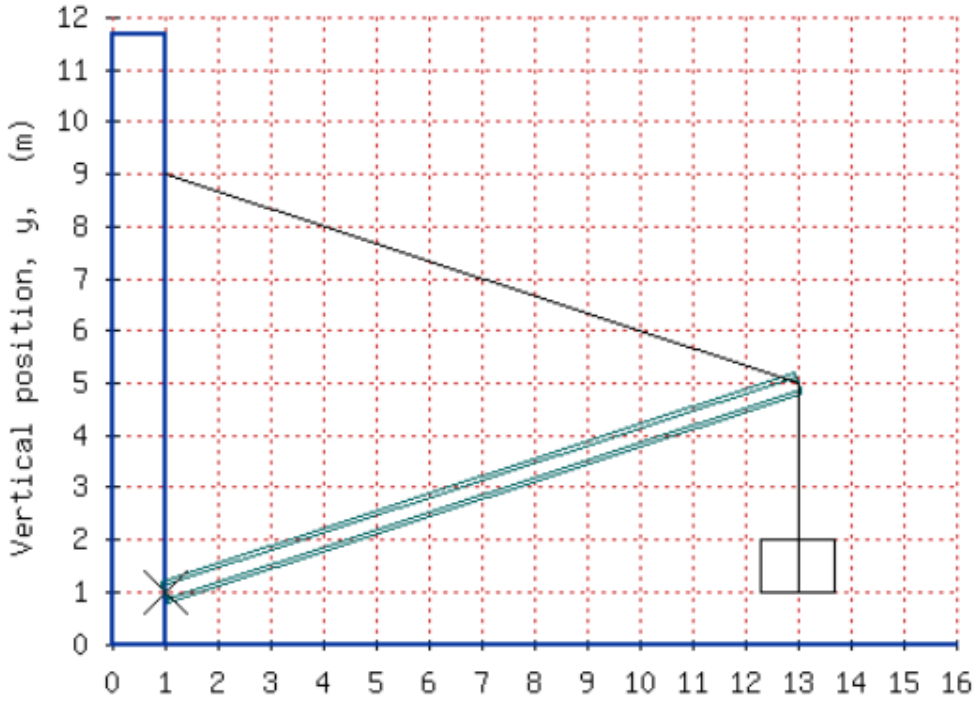
- … or simulations and animations …



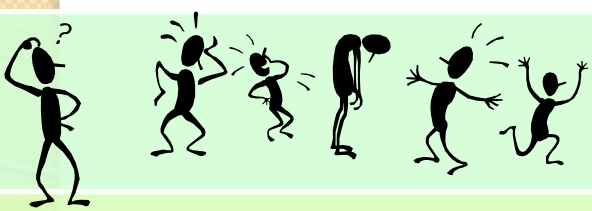
Shared Resource Library

- … or this kind of randomizing online problems

A crate with a mass of 155.5 kg is suspended from the end of a uniform boom with mass of 89.5 kg. The upper end of the boom is supported by a cable attached to the wall and the lower end by a pivot (marked X) on the same wall. Calculate the tension in the cable.



LON-CAPA Architecture



Course Management

Campus A

Resource Assembly

Course Management

Campus B

Resource Assembly

Shared Cross-Institutional
Digital Resource Library

Resource Assembly

- Take shopping cart to the supermarket

Domain - sc (University of South Carolina)

Domain - sfu (Simon Fraser University)

- batchelo
- chem281
- exafs
- hanlan
- mxchen
- slavieri
- vjungic

Domain - sunysb (SUNY Stony Brook)

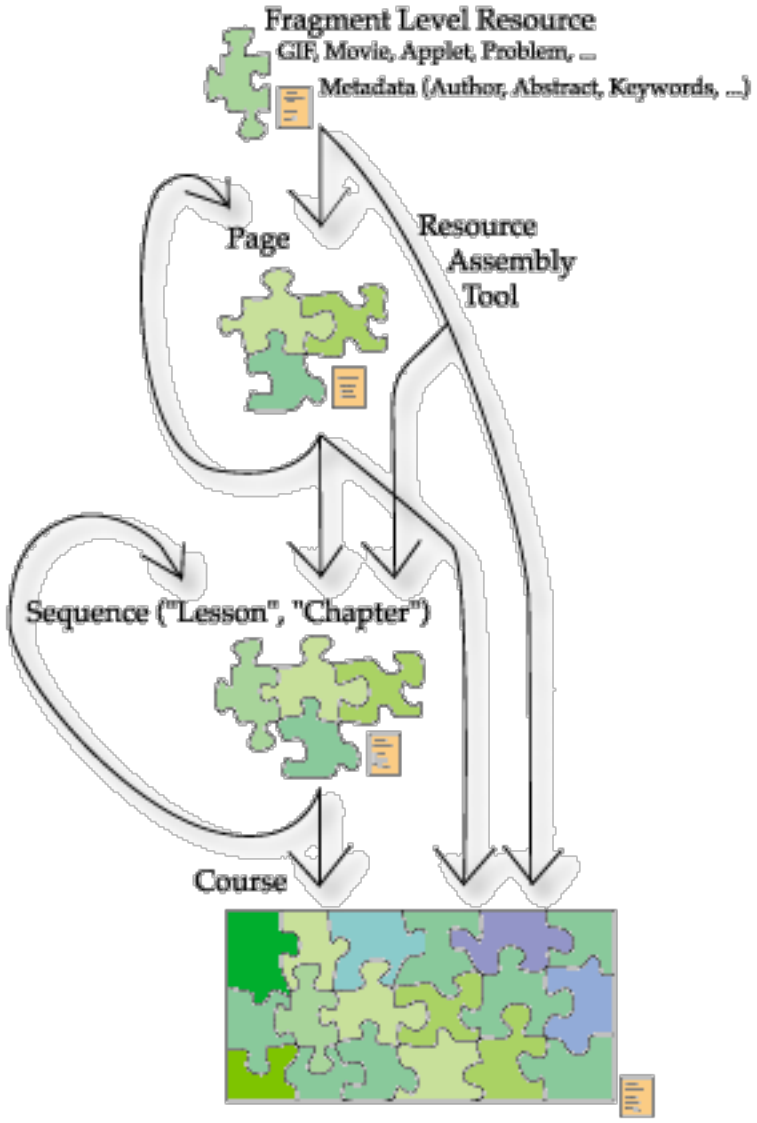
Domain - tmcc (Truckee Meadows Community College)

- jensen
- mbauer
- souza
  - Greenberg
    - default.sequence (metadata)
  - samples
- testuser1

Domain - ucf (University of Central Florida)

Resource Assembly

- Nested Assemblies
- No pre-defined levels of granularity („module“, „chapter“, etc)
  - People can never agree what those terms mean
- Re-use possible on any level
  - Customize your table of contents



Resource Assembly

Writes module about energy conservation

Compiles module about conservation laws

Writes module about momentum conservation

Uses whole assembly in his course

LON-CAPA Architecture

Course Management

Campus A

Resource Assembly

Course Management

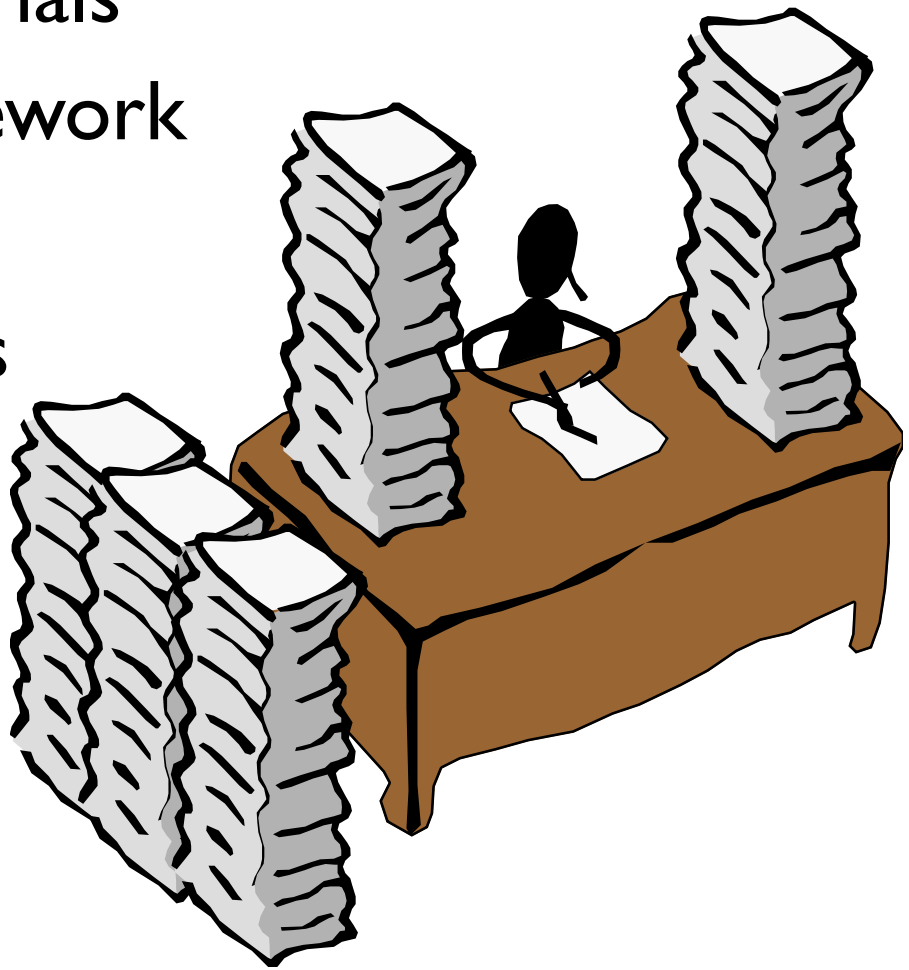
Campus B

Resource Assembly

Shared Cross-Institutional
Digital Resource Library

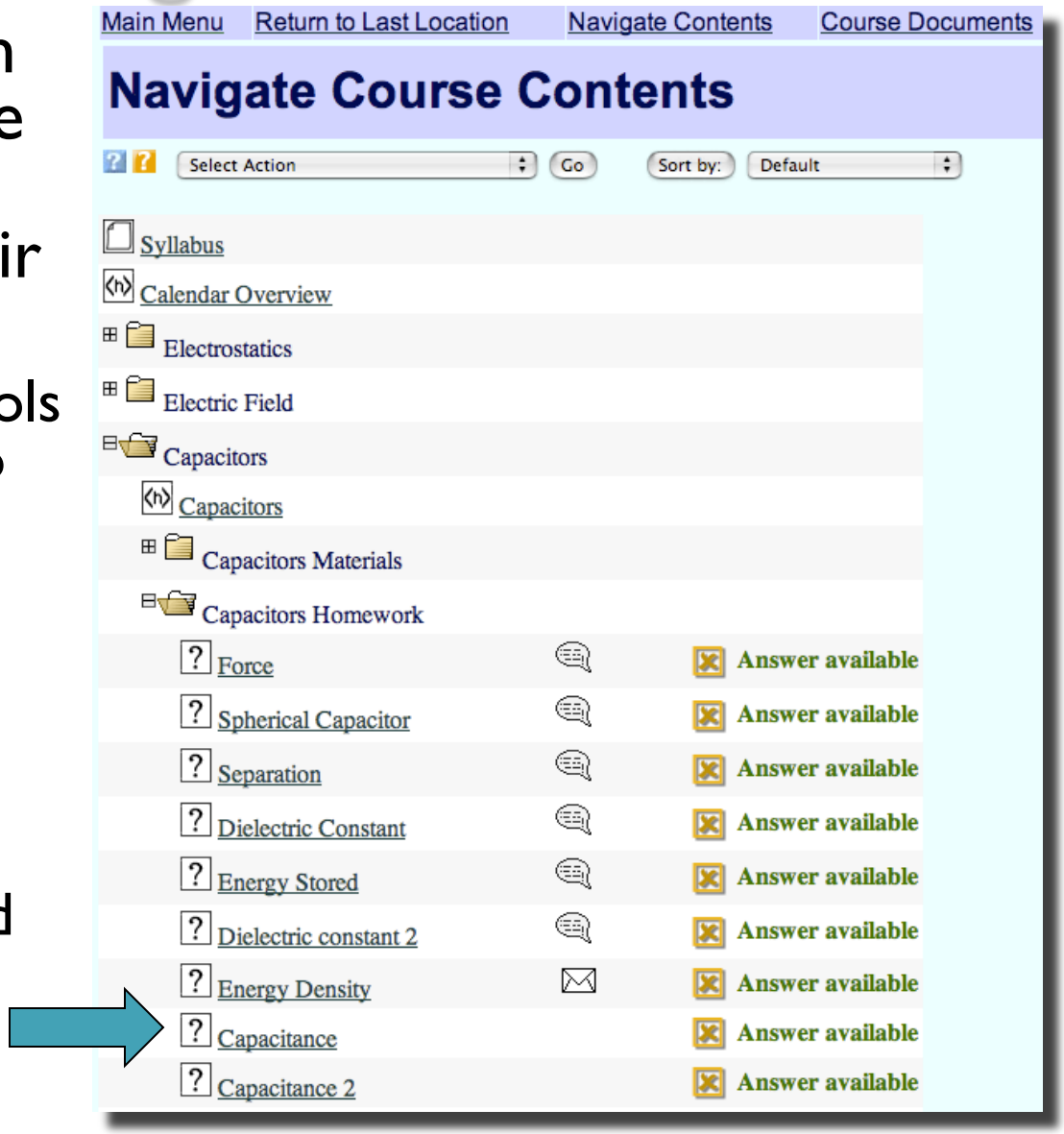
Course Management

- Posting of materials
- Posting of homework
- Discussions
- Announcements
- Portfolios
- Scheduling
- Gradebook
- …

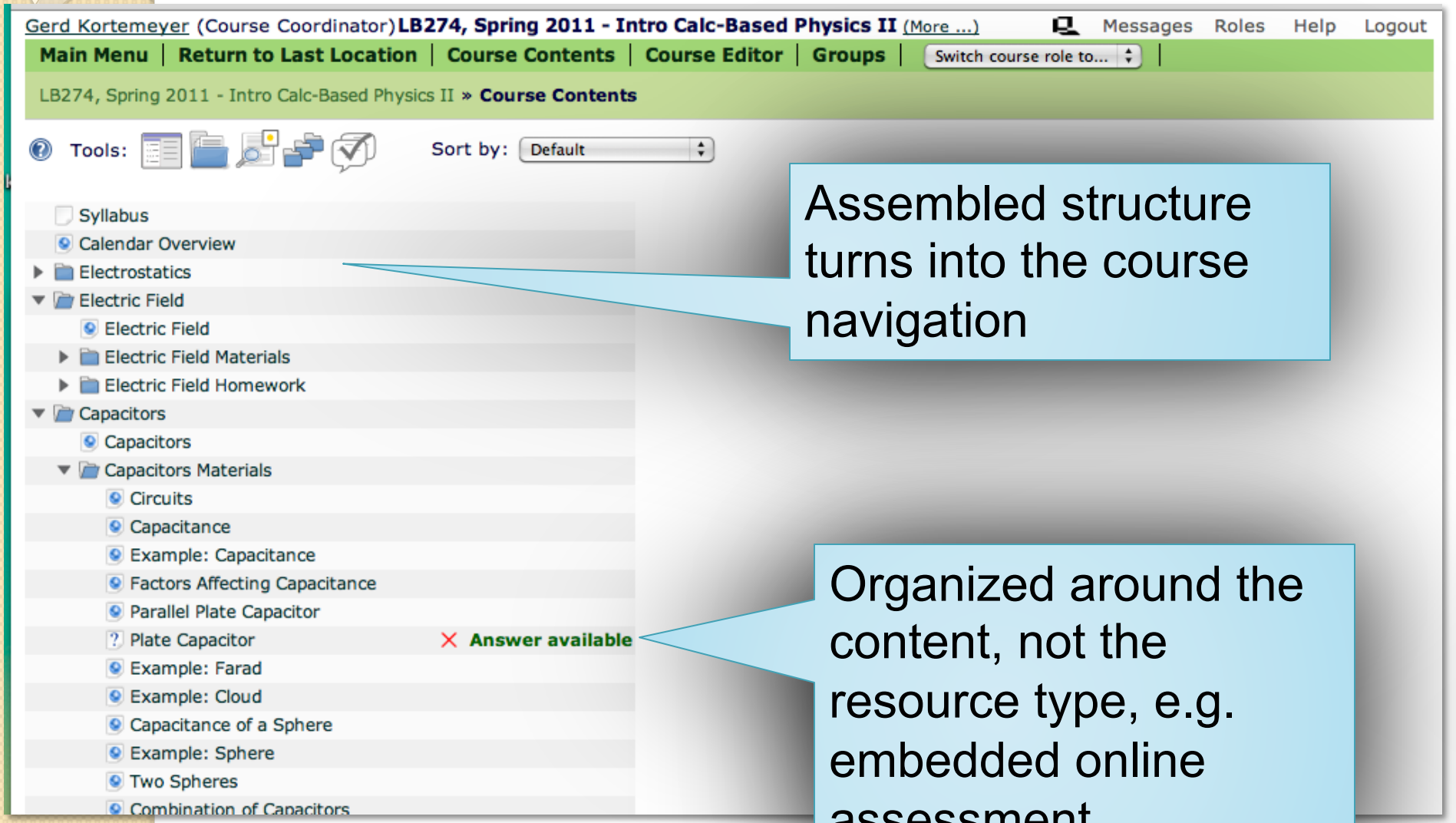


Course Management

- Instructors can directly use the assembled material in their courses
  - navigational tools for students to access the material
  - access rights management
  - timing
  - contextual discussions and messaging



Course Management



Course Management

- Course overview/dashboard

Course Action Items

Gerd Kortemeyer
Course Coordinator
LBS 272 - Spring 2006

LBS 272 - Spring 2006 ->**Display Action Items** What's New?

Go to first resource

Page set to be displayed after you have selected a role in this course? Currently: *What's New? page (user preference)* **Change** for just this course or for all your courses.

Hide all Show all

Problems requiring handgrading Hide

Problem Name	Number ungraded
Electric Field	4

Problems with errors Hide

No problems with errors

Problems with av. attempts ≥ 3 or deg. difficulty ≥ 0.8 and total number of students with submissions ≥ 4 Hide

Change thresholds?

Resource	Part	Num. students	Av. Attempts	Deg. Diff	Last Reset	Reset Count?
Field Lines	single part	24	2.12	0.84		☐
Net Force	single part	53	2.49	0.80		☐
Pith Balls	single part	52	4.12	0.90		☐

Reset counters to 0

Resources in course with version changes since last week Hide

Change interval?

Resource	Last revised	New version	Version used
Applet: Electron Orbit	Fri Jan 13 10:18:52 2006 (EST)	10	10
Capacitance of a Sphere	Mon Jan 16 12:03:13 2006	8	8

Unread course discussion posts Hide

Change options?

Location	Type	Time of last post	Number of new posts
Coulomb	Resource	last Monday, Jan 16 at 04:55 pm (EST)	1
Distance Change	Resource	last Monday, Jan 16 at 07:00 pm (EST)	1
Field Lines	Resource	last Monday, Jan 16 at 07:49 pm (EST)	1
Force	Resource	on Wednesday, Jan 11 at 07:01 pm (EST)	3
Net Force	Resource	23 hours, 19 minutes ago	5
Pith Balls	Resource	last Monday, Jan 16 at 09:21 pm (EST)	6
Point P	Resource	last Friday, Jan 13 at 02:34 pm (EST)	5
Potential	Resource	last Sunday, Jan 15 at 03:15 pm (EST)	1
Two Charges	Resource	last Sunday, Jan 15 at 03:26 pm (EST)	1
Vector	Resource	last Saturday, Jan 14 at 01:32 am (EST)	1
Vectors	Resource	last Saturday, Jan 14 at 12:09 pm (EST)	2

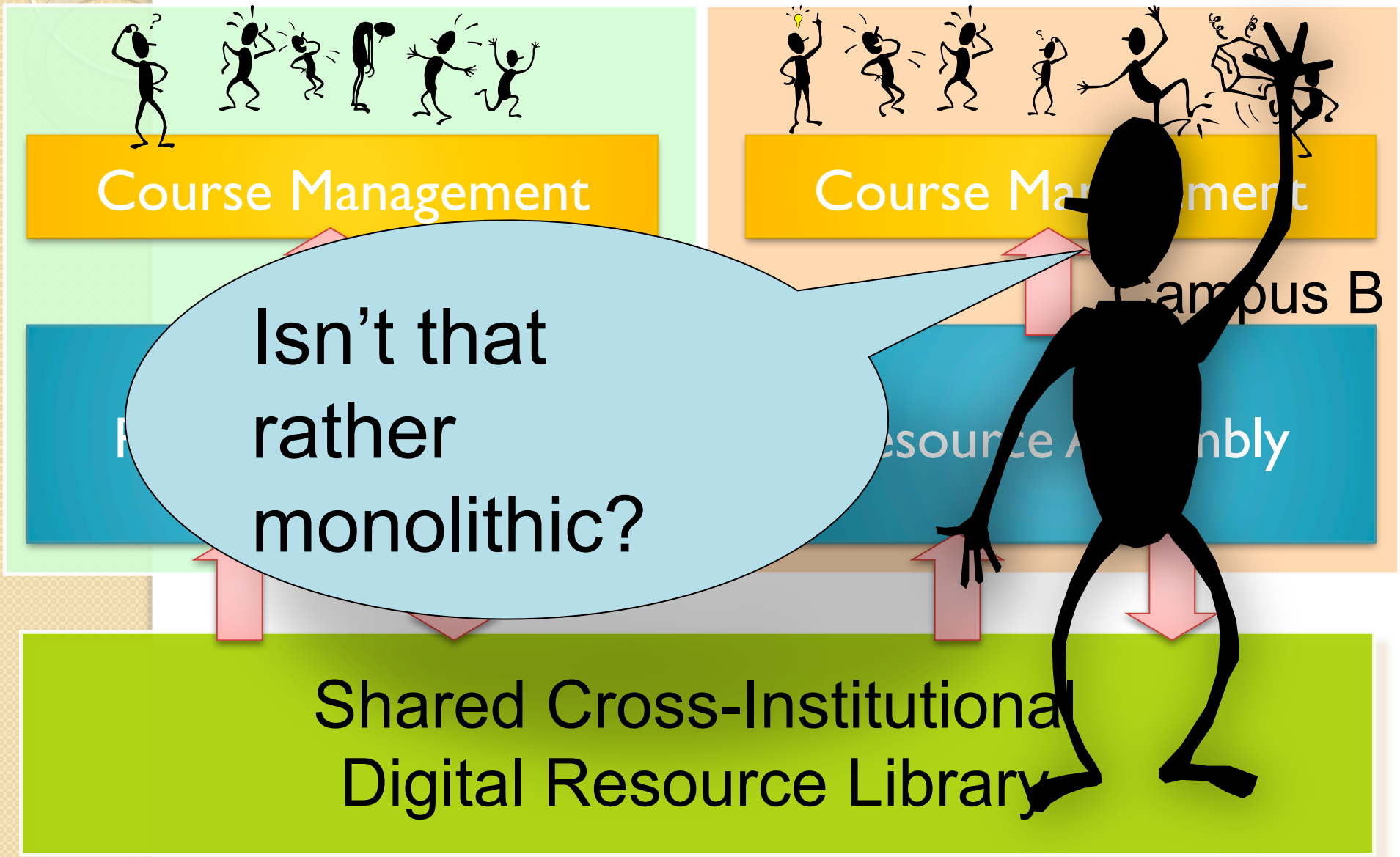
New course messages Hide

Number	Subject	Sender	Date/Time
1.	Feedback [msu/mmp/kap18/problems/cd460.problem]	[redacted]@msu	Sat Jan 14 10:45:02 2006 (EST)

New critical messages in course Hide

No unread critical messages in course

LON-CAPA Architecture

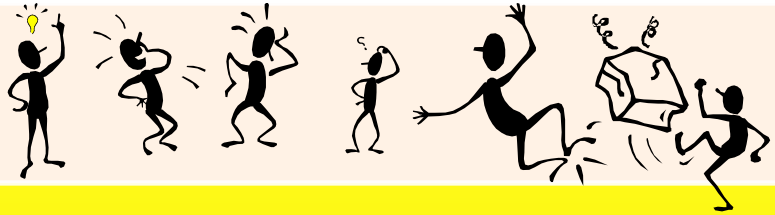


Dynamic Metadata

Course Management

Campus A

Resource Assembly



Course Management

Campus B

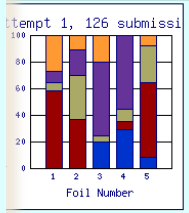
Advantage:
- Feedback from all levels
- The system gets to know the resources

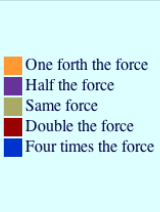
Shared Cross-Institutional Digital Resource Library

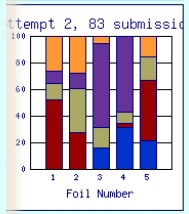
Dynamic Metadata

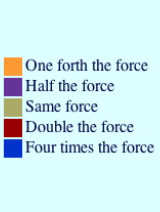
- Dynamic metadata from usage
- Assistance in resource selection („amazon.com“)
- Quality control

Foil Number	Foil Name	Foil Text	Correct Value
1	1_6_1_1_2	The distance between the two charges is cut in half.	Four times the force
2	1_6_1_2_2	The magnitude of both charges is doubled.	Four times the force
3	1_6_1_3_2	The magnitude of one of the two charges is doubled.	Double the force
		stance between the charges is doubled.	One forth the force
		arges are placed in a medium with a factor two higher permittivity.	Half the force









Access and Usage Statistics

Network-wide number of accesses (hits)	890
Number of resources using or importing resource	1 • Eukaryotic Gene Control [msu/bio/Gene_Expr/111f03GeneCntrl.sequence]
Number of resources that lead up to this resource in maps	1 • Back to the Original Question [msu/bio/Gene_Expr/problems/originalquestion.problem]
Number of resources that follow this resource in maps	1 • Eukaryotic vs Prokaryotic Gene Expression II [msu/bio/Gene_Expr/problems/eukvsprokII.problem]
Network-wide number of courses using resource	3 • LBS 145 - Spring 2004 • ZOL 341 - Fall 2003 • BS 111 - Fall 2003

Assessment Statistical Data

Total number of students who have worked on this problem	291
Average number of tries till solved	1.37
Degree of difficulty	(0.36)

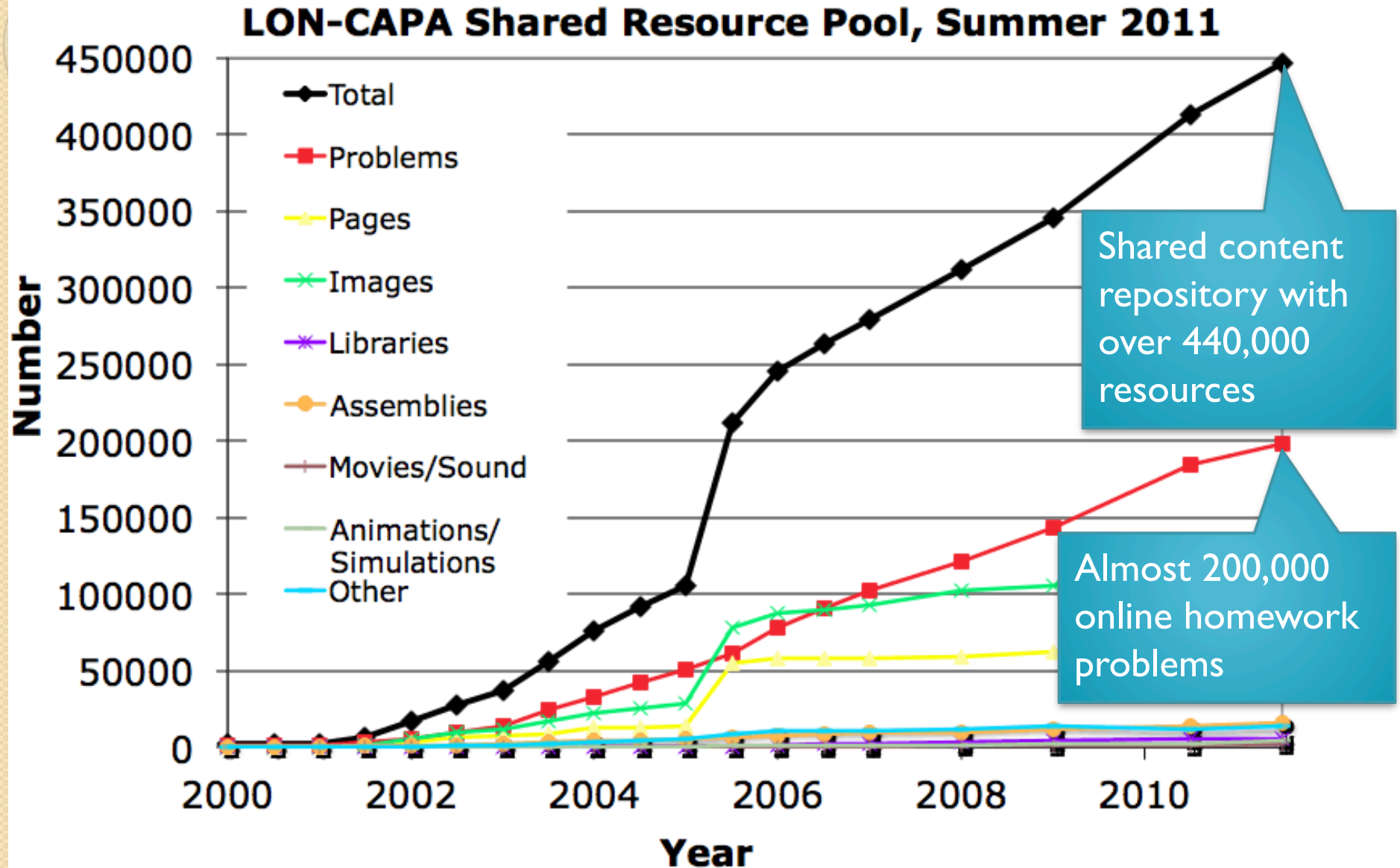
Dynamic Metadata

- More useful than static metadata
- Authors
  - spend hours writing beautiful resources
  - do not spend five minutes to fill out even the most basic information
- Dynamic metadata shows the resource "in action"

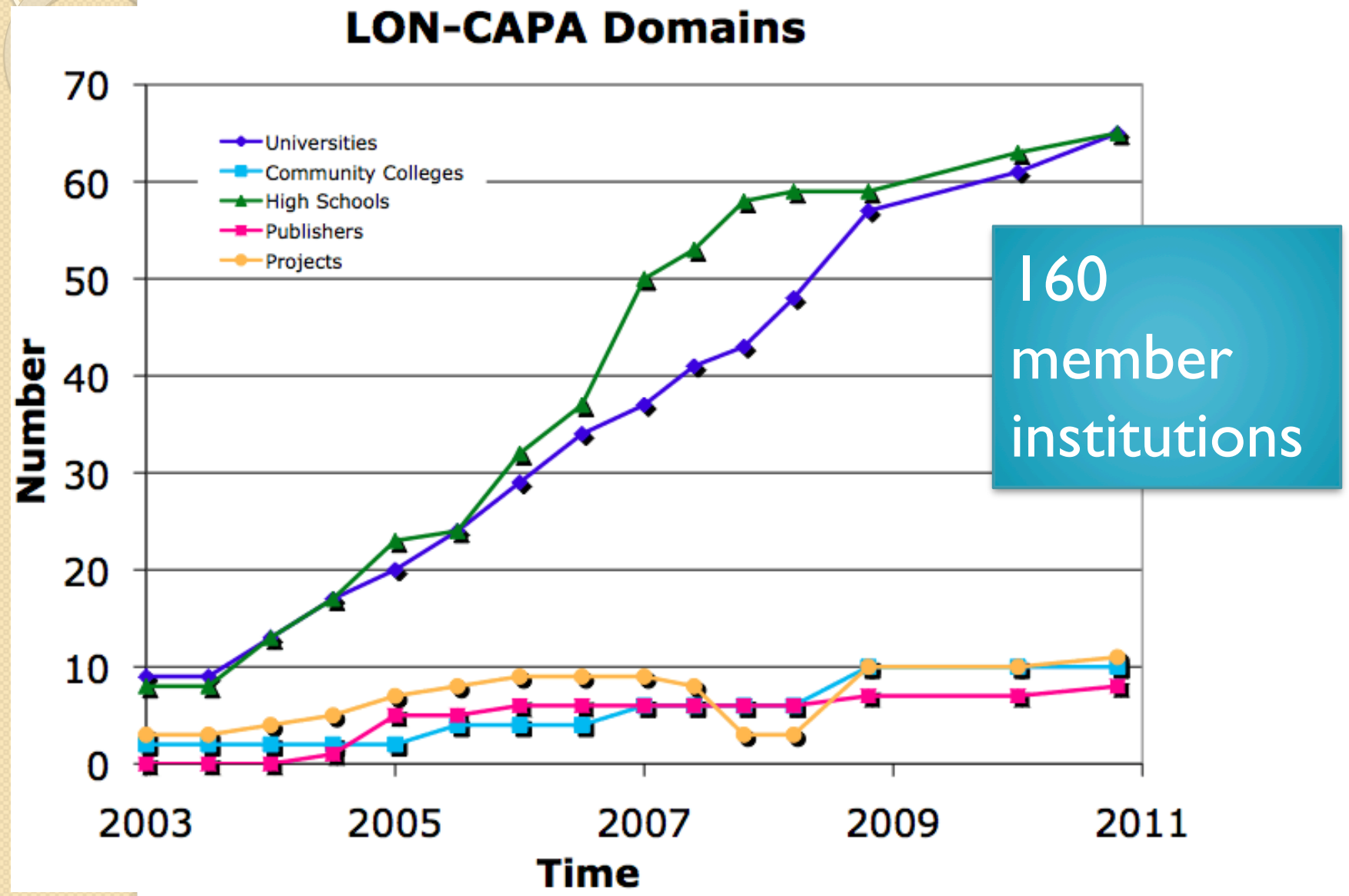
The LON-CAPA Community

- Does this work?
- Does it scale?

Shared Resource Library



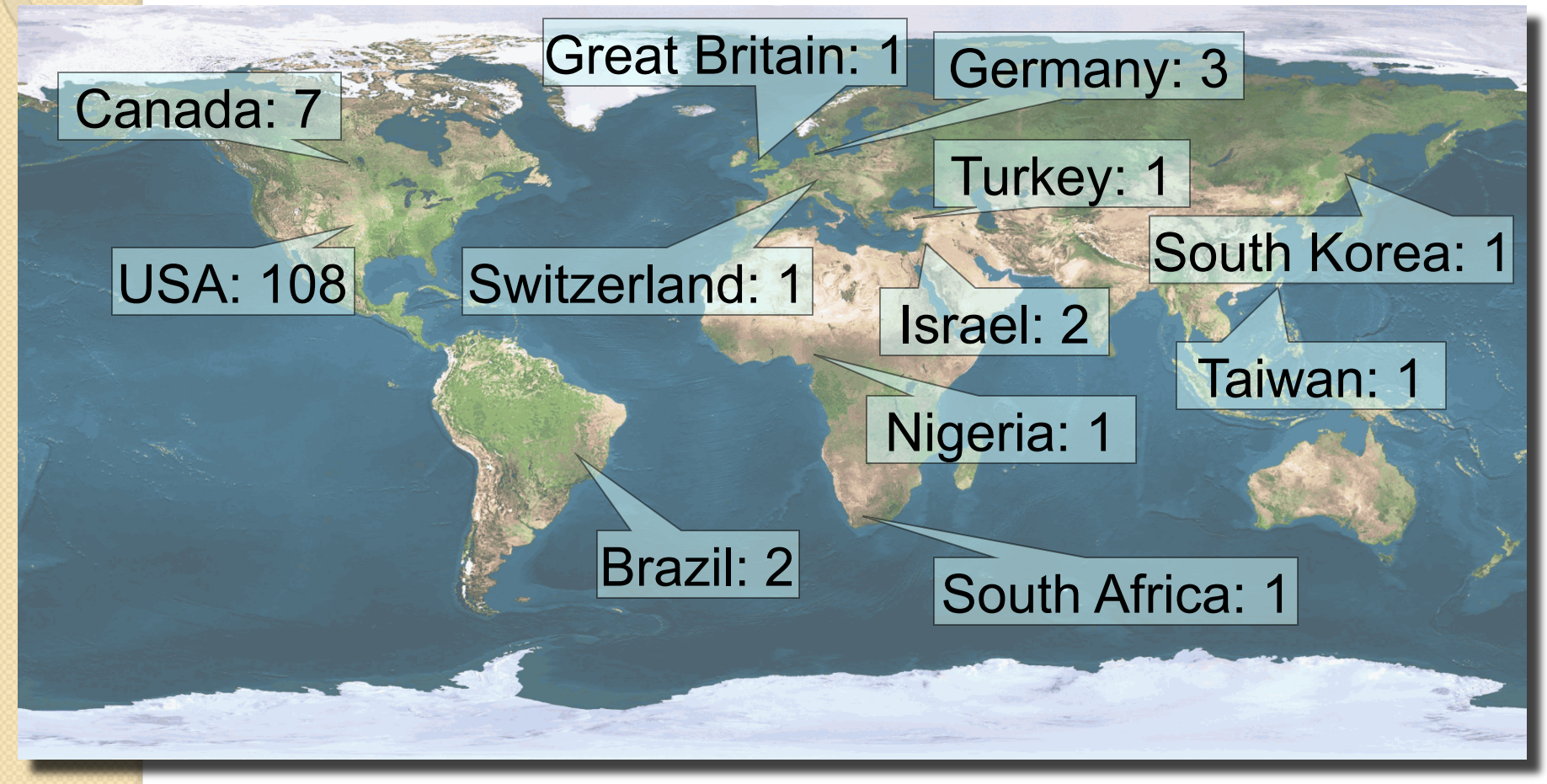
The LON-CAPA Community



160 member institutions

The LON-CAPA Community

High Schools, Colleges, and Universities



… plus grant projects and publishing companies.

The LON-CAPA Community

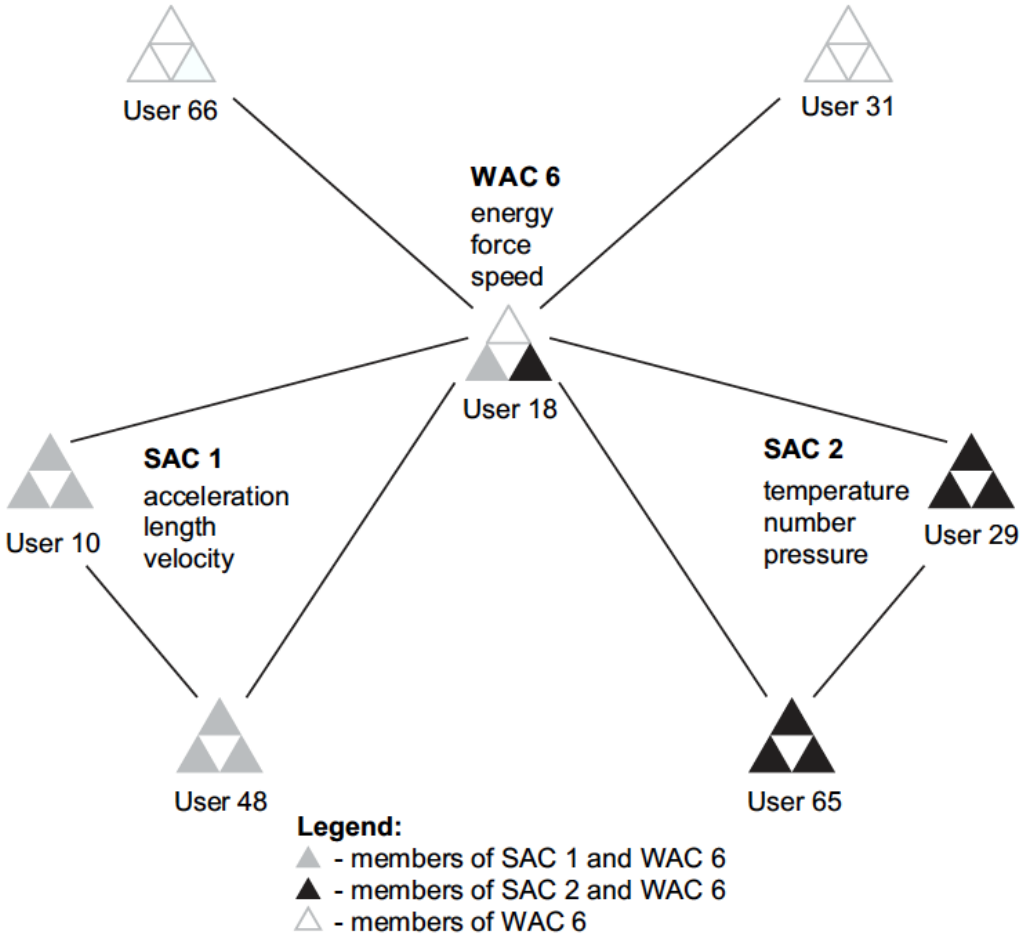
- Cross-institutional use

old data!

		U01	U04	PR01	U06	U17	U05	U03	HS20	U12	PR06	U11	U08	U
	Available	144418	17545	10809	8799	7635	7037	5120	4439	4066	3750	3283	2989	27
	Used	38245	7596	340	4821	2908	4880	3411	3842	2811	1502	1231	2102	3
	Used externally	17099	1804	339	974	276	3507	1735	1035	1987	1502	415	62	3
	Using													
U01	38855	34790	301	105	17	49	1621	294	74	102	298	137	3	
U05	11668	4881	23	14	3	33	4357	866	29	500	328	5	3	
U04	10343	2393	6969		10		207	374	8	128	2	18		
U06	10089	2261	64	13	4755		305	1001	8	10	2	72	2	2
U03	9973	4053	58	27	5	84	1213	3173	7	728	14	166		
U08	8578	2014	1078	6	2	2	720	5					2097	
HS20	6465	2138	1	47			40	350	3767	21	70	4		
CC04	6356	1156	25		2	31	1586	789	197	1522		64	7	
U17	6270	2689	4	7		2813	188	205	94	140	4		2	
HS40	5251	3899	22	5		40	65	293	388	70	27	16	1	
U14	5135	1682	213	42	12	1	665	42		3	7	114		
U09	4246	3409	7		1			15		1		1		
U12	3768	184					136	760		2684				
HS39	3467	2101	19	20	5	2	68	26	29	1	808	71		

The LON-CAPA Community

- Creates communities of practice!
- Connects colleagues doing the same thing



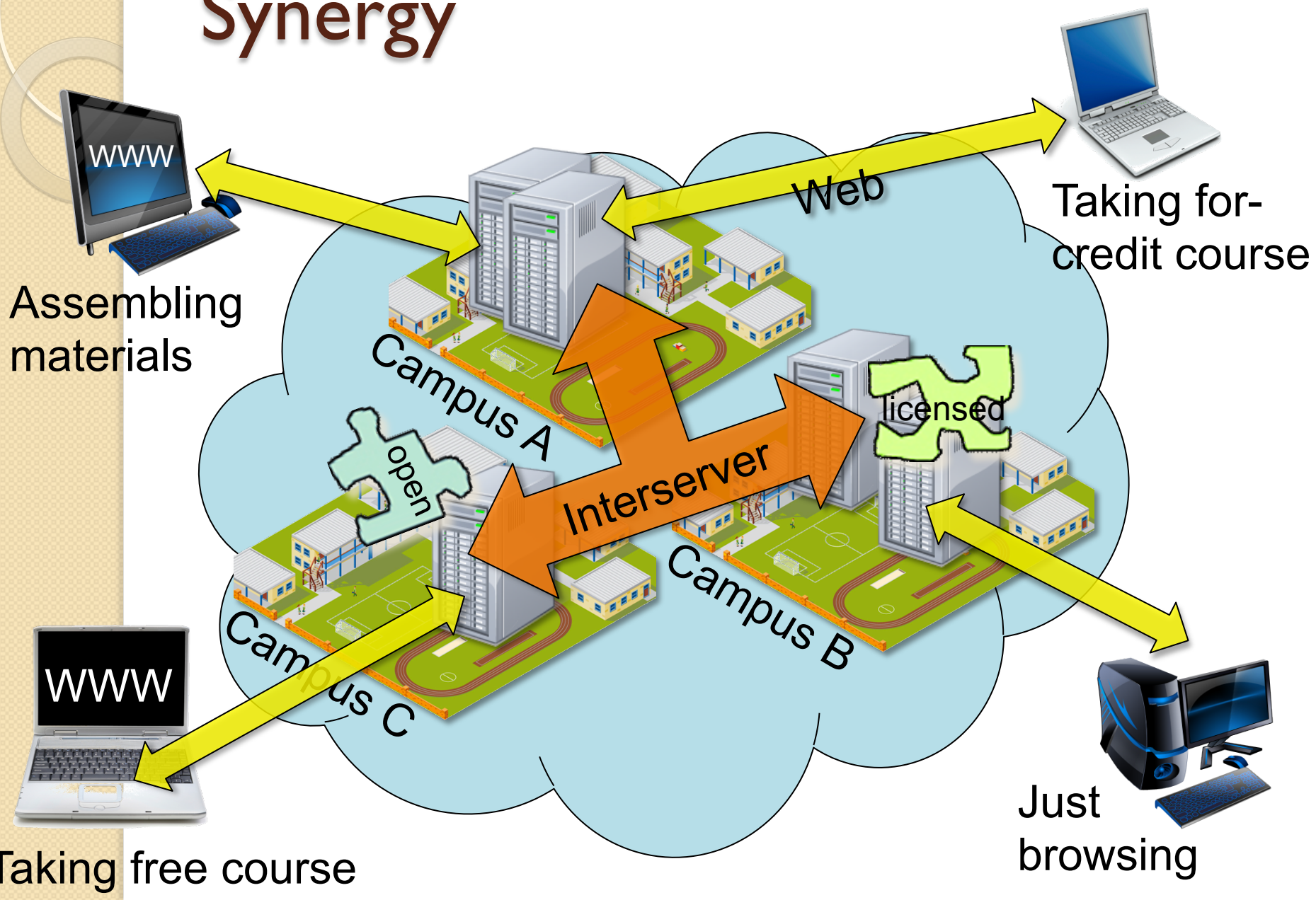
Synergy

How can all of this benefit the OER Community?

- Dynamic platform to assemble, remix, and deploy OER content
- Built-in course management
  - No download
  - No content cartridges
- Learning content management
  - Search
  - Versioning
  - Recommendations
- Digital Rights Management
  - Commercial, licensed, and open content can co-exist in the same pool
  - Expand to accommodate Creative Commons (was not around 20 years ago!)

Build a distributed OER infrastructure

Synergy



Thank you!

- Thank you!
- Gerd Kortemeyer
Michigan State University
http://www.lite.msu.edu/kortemeyer/
korte@lite.msu.edu