



# *Connexions*

**Building Communities  
and  
Sharing Knowledge**

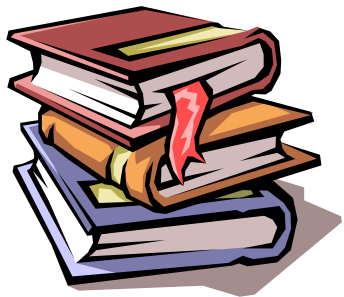
**[cnx.rice.edu](http://cnx.rice.edu)**



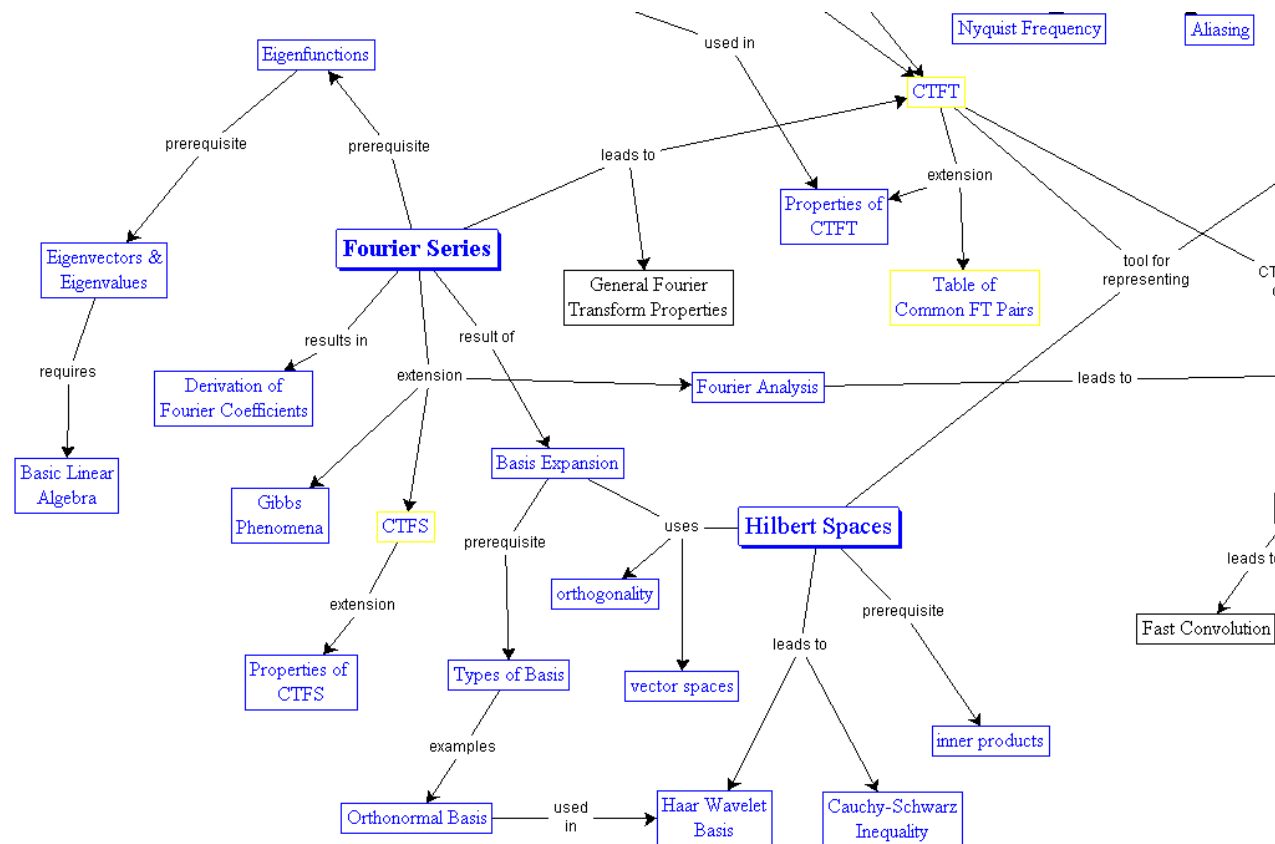
# from Traditional Publication ...

- **Content/Knowledge**

- disconnected; stove-piped
- difficult to integrate across disciplines
- difficult to reach different learning styles
- limited access



*versus*





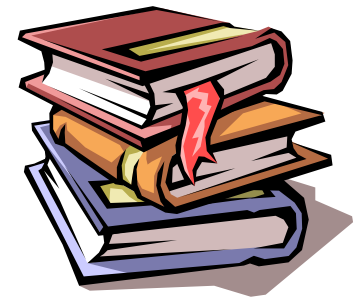
# from Traditional Publication ...

- **Content/Knowledge**

- disconnected; stove-piped
- difficult to integrate across disciplines
- difficult to reach different learning styles
- limited access
  
- glacially slow development process
- static

- **Communities**

- poorly supported
- collaboration difficult
- limited feedback
- not sustainable





# ... to *Collaborative* Publication

- **Connexions:** collaboration on a *global spatial scale* and *fine time scale*
- **Aim:** change the nature of interactions among *people* and *content*

*scientists*

*organizations*

*educators*

*governments*

*public*

*students*

*industry*



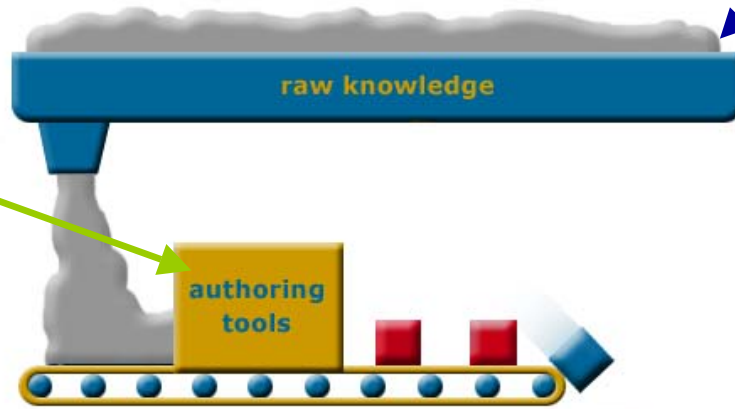
# ... to *Collaborative* Publication

- ***Connexions***: collaboration on a *global spatial scale* and *fine time scale*
  - enabled by the *semantic web*
  - *commons* of *free* materials; *open* to all
  - *modular* content; encourages *reuse*
  - collaboratively authored by *communities*
  - *grassroots* organization; *cross-institutional*
  - *quality assessment*
  - *open-source software tools and architecture*
  - visualize and navigate *connexions* among concepts, courses, and curricula



# Connexions

Authors



*ideas  
information  
concepts*

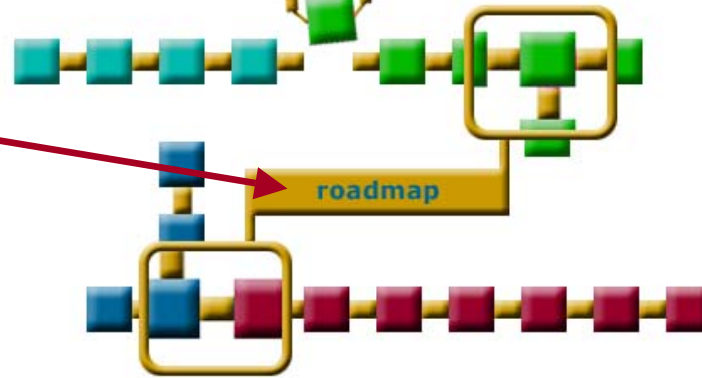
Instructors



Module

***Content  
commons***

Students

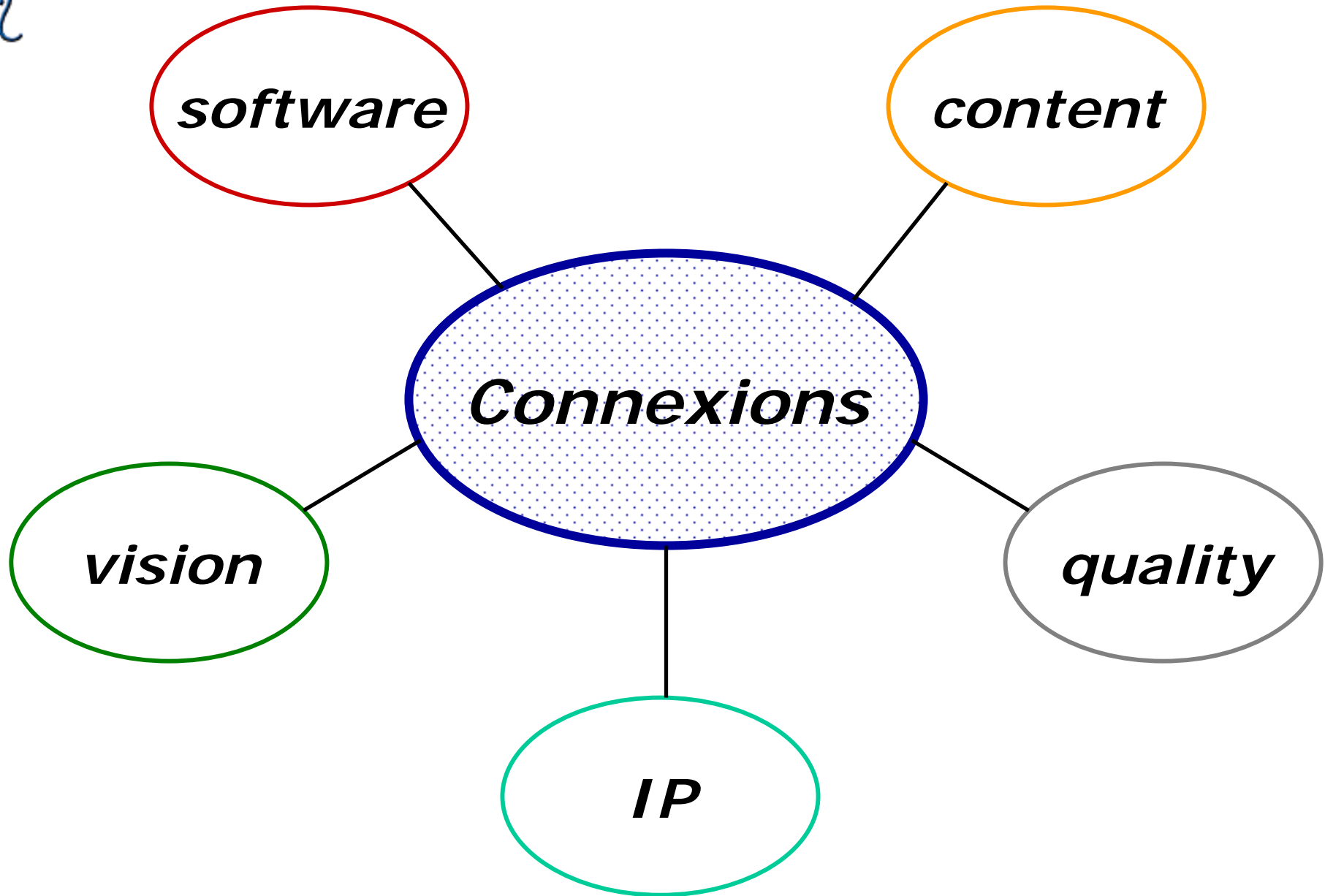


Courses



# Connexions

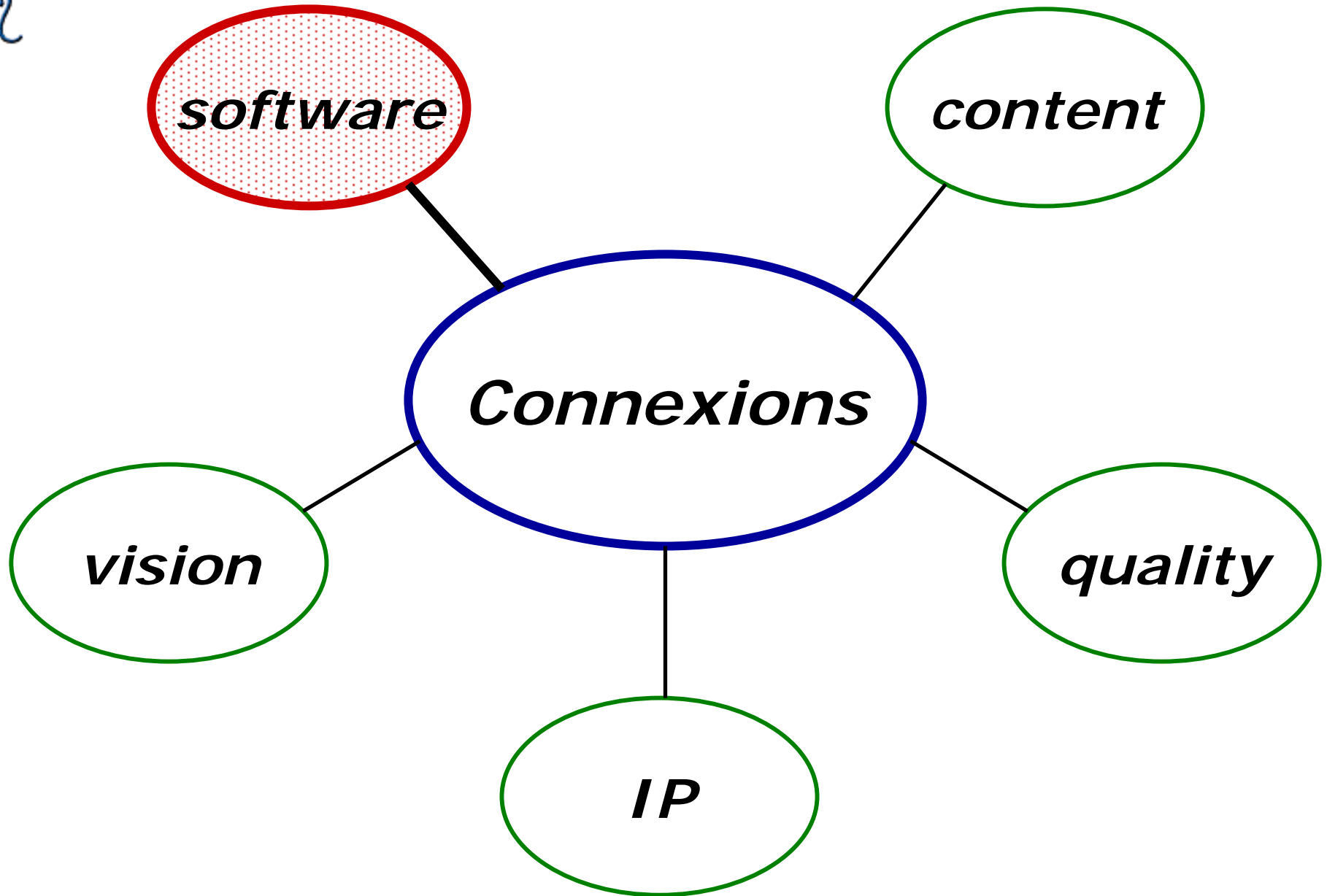
- Connecting *concepts* *people*  
*ideas*  
*data*
- Building *commons* *communities*
- Universal *challenges* and *solutions*





# Enabling a Commons

1. Common cultural *vision, goals, norms*
  
2. Common *technology framework*
  - enable *reuse, sharing*
    - must integrate technology into content
    - modularity, semantic markup (XML), meta data, ...
  
  - support *connectivity*
    - hyperlinks, ...
  
  - *manage* modules and courses
  
- 3.



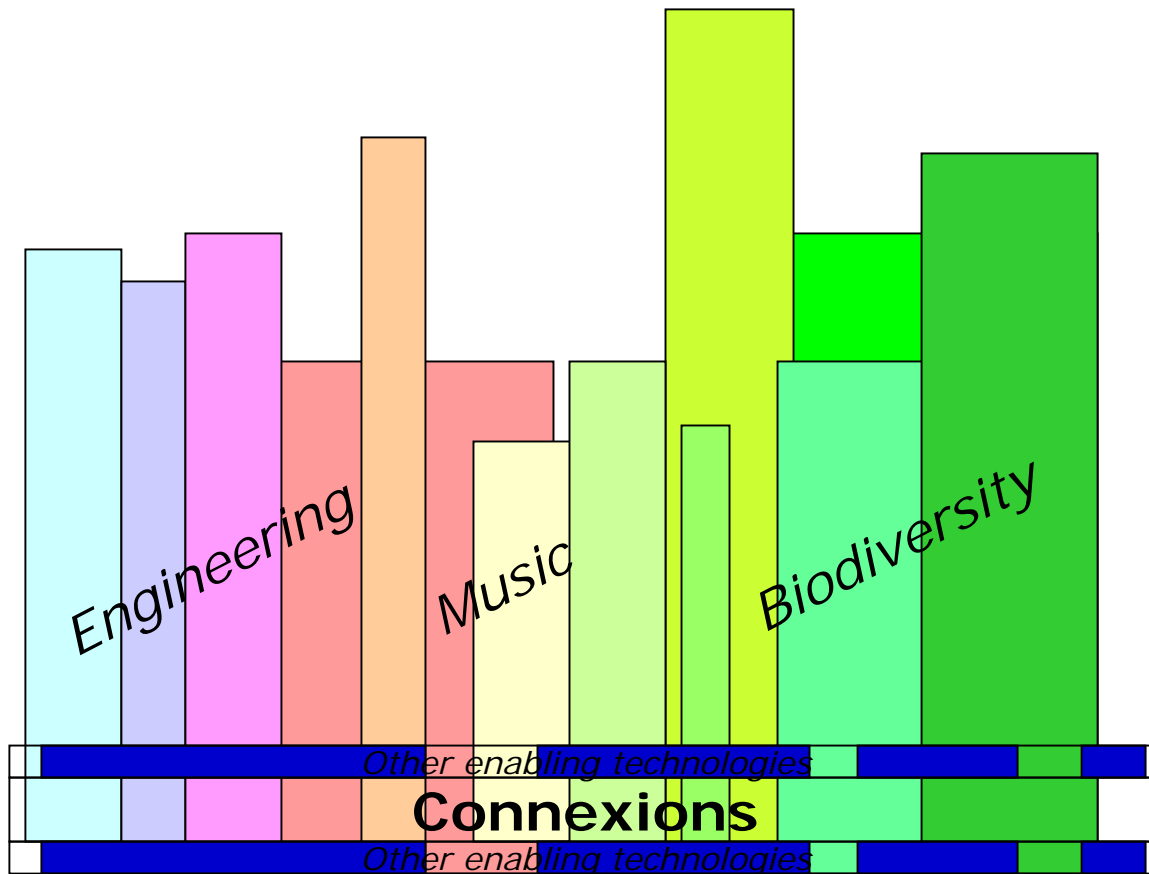


# Technology and Tools

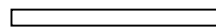
- Content *modules* encoded in *XML*
  - *Database* to organize modules (eventually distributed)
  - *Authoring tools and workgroups* to facilitate collaboration
  - *Course Composer* to assemble modules
  - *Annotation* to personalize modules
  - *Roadmap* to navigate and explore
  - *Discussion forums* for feedback, communication
- 
- All tools *free* and *open source*
  - Tools in *live use* at a range of institutions globally
  - Full Version 1.0 launch February 2004



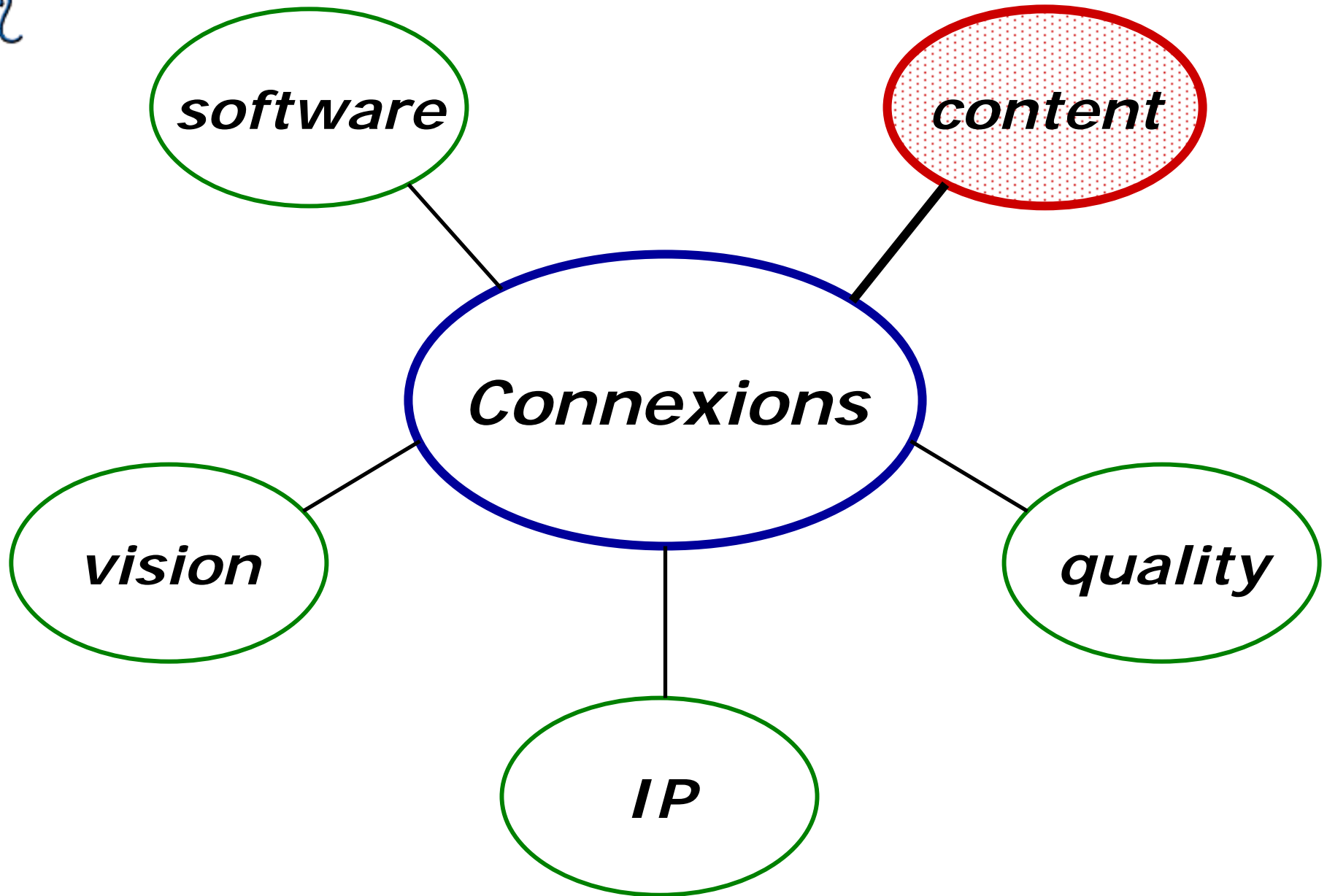
# CNX – An *Enabling* Technology



Specialized applications



Enabling technologies





# Content Commons

**If** content freely available to  
*read, copy, modify, redistribute*

**Then** global *communities* of authors can continuously  
*create, expand, revise, and maintain*  
modules and courses

Models from *open-source, community-developed software*  
*GNU/Linux, Apache, Mozilla/Netscape, ...*



# Some Benefits

- *Connectivity*
  - students/instructors can see/explore  
*connexions between ideas*
  - enables *cross-disciplinary education*
  - draw recent research results into educational process
  
- *Breaks down barriers* to entering author *community*
  - drastically *reduces author time commitment*
  - authors write about what excites them
  - broader impact for teaching materials
  - more teachers will become authors



# Some Benefits

- *Efficient* development
  - leverages efforts of a global community
  - modules / courses *reusable* in new contexts
  - holistic, *evolutionary curriculum development*
  
- *Dynamic – iterative refinement – evolution*
  - “close the loop” in cycle of
    - *develop* learning materials
    - *use* them for learning
    - *assessment* feedback



# Opportunities for Academics

- Connecting *content* with *context*
- Multimedia content
- Leveraging and *extending academic culture* and enterprise globally
  - new opportunities to *interact*
  - diversity, innovation, dynamism, feedback
- *Broader impact* for teaching materials
- Supporting emergence of *new disciplines*
  - nanotechnology, bioinformatics, complex systems...



# Prototype Communities – 1

- *Cross-institutional* in Digital Signal Processing (DSP)
  - Rice, Illinois, Ohio State, Georgia Tech, Michigan, Wisconsin, Polytechnic, Cambridge (UK)
  - National Instruments and Texas Instruments
  - *spontaneous contributions* from NTNU (Norway), University of Verona (Italy)
- Complete Rice Electrical and Computer Engineering *core undergrad curriculum*
  - goal: 15+ interlinked courses with prerequisites
  - 1/3+ complete



# Prototype Communities – 2

- ***Botany/Biodiversity***
  - Andes/Amazon project (BRIT)
  - American Museum of Natural History, CBC
- ***Bioinformatics*** (Rice, Baylor, MD Anderson, UH)
  - genetics, statistics, computer science, bioengineering, ...
- ***Music*** appreciation and theory (K-12 and college)
- Computer science, mathematics, nanotechnology, civil engineering, physics, complex systems, UNESCO, Sigma Xi, UN, ...
- **Progress:** **38+ courses in *live use*, 1800+ modules**



# Content Commons Growth

- **Modules** in the commons

- 1800 modules
- 38 courses  
(June 2004)
- multiple languages

ECE, CS, bio-info,  
math, nanotech,  
physics, stats,  
botany, music, ...  
from authors

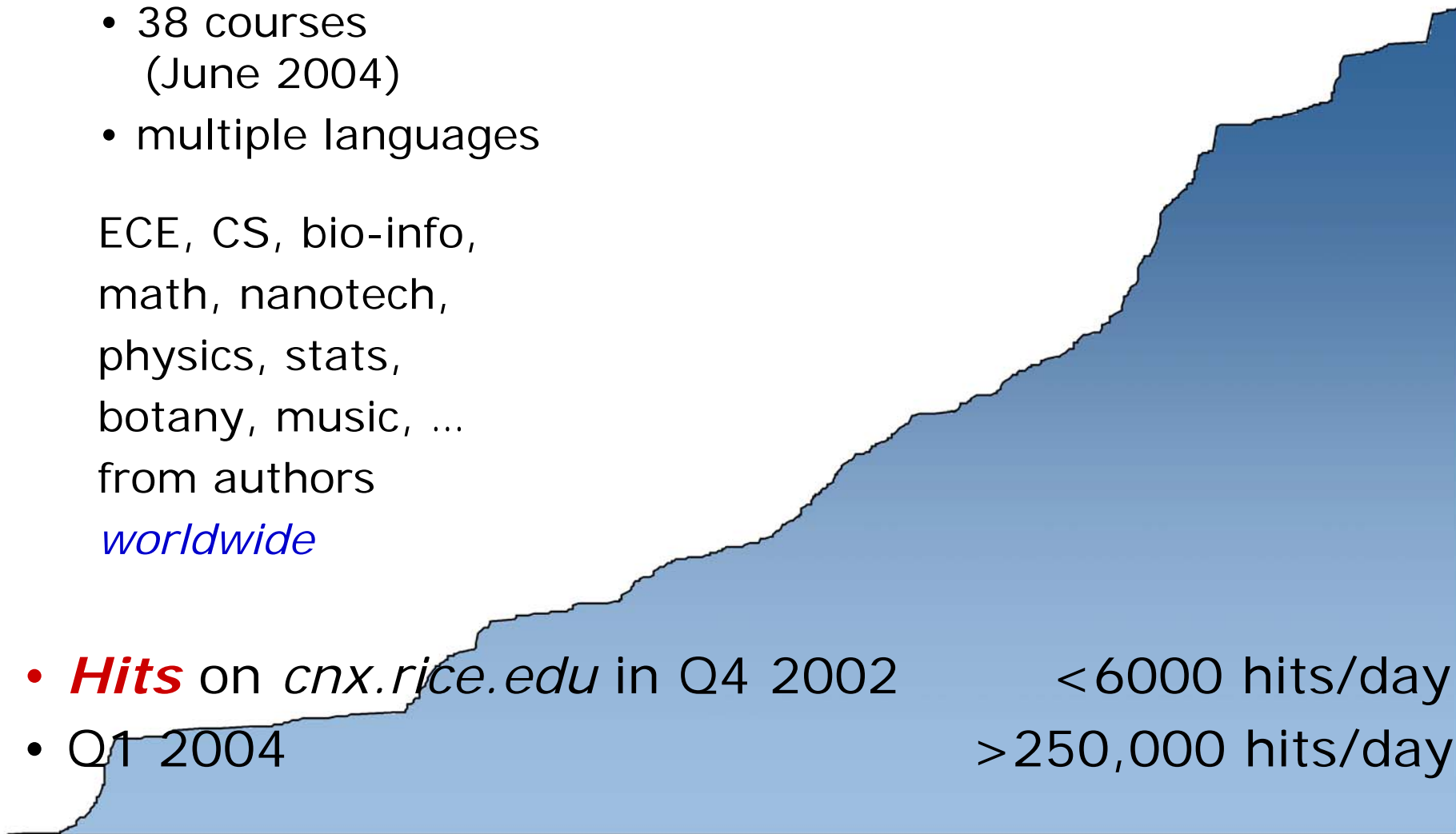
*worldwide*

- **Hits** on *cnx.rice.edu* in Q4 2002

< 6000 hits/day

- Q1 2004

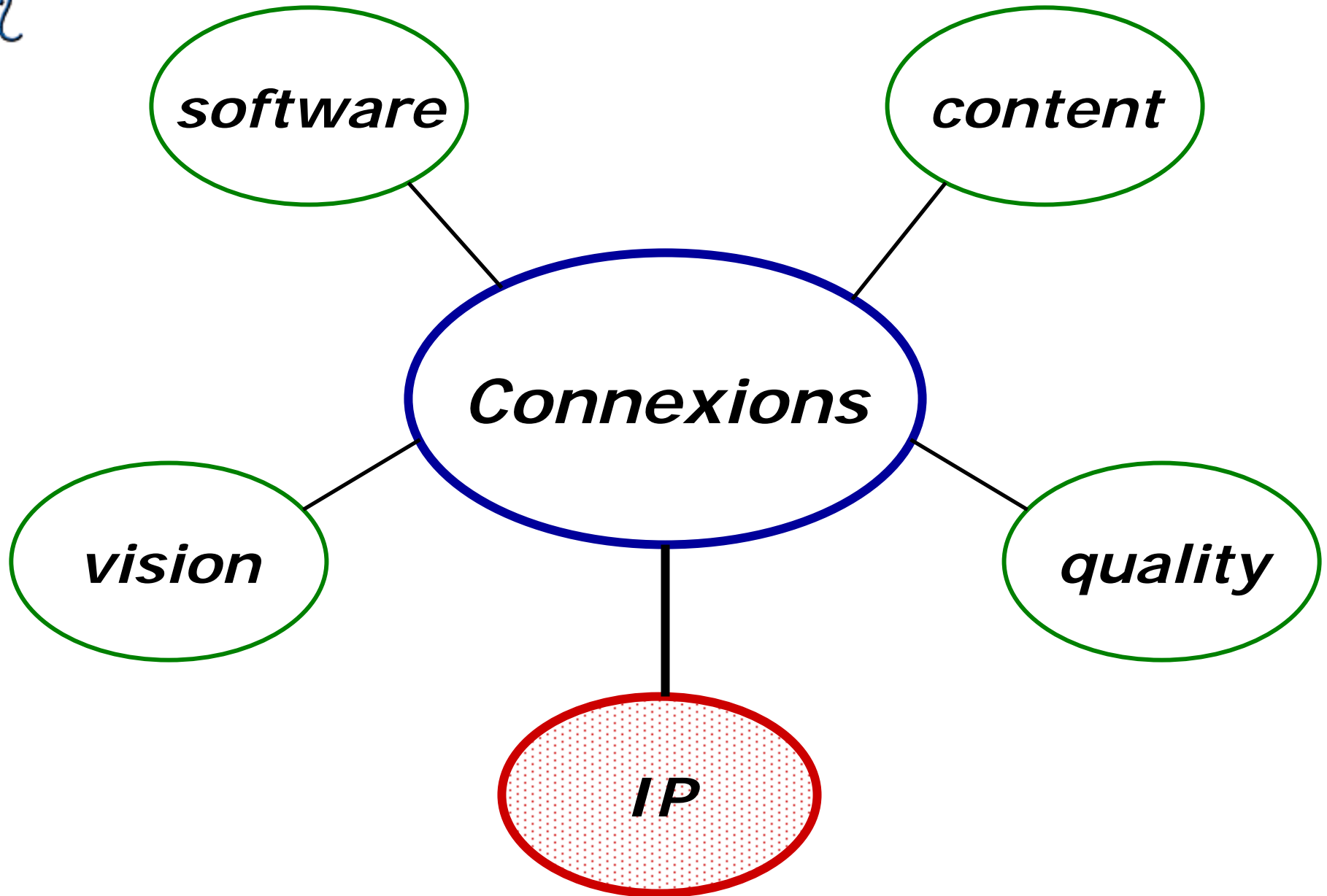
> 250,000 hits/day





# Enabling a Commons

1. Common cultural *vision, goals, norms*
2. Common *technology* framework
3. Common *intellectual property* framework
  - module *reuse* typically requires *modification*
  - busy faculty do not have time to chase down copyright holder (*not scalable*)
  - must be integrated into content





# Open Content Licensing

- Current IP regime *discourages sharing*
- *Creative Commons* Licenses
  - *common legal vocabulary* for sharing content
  - create a kind of “public domain” using licensing
  - collaborators since August 2002 (versions 1.0, 2.0)
  - license provisions:
    - *author retains copyright* on each module / course
    - *author licenses* material to the world at large
    - ✓ attribution
    - ✓ commercial use
    - ✓ derivative works (modification)
    - ✓ share alike (“copyleft”)

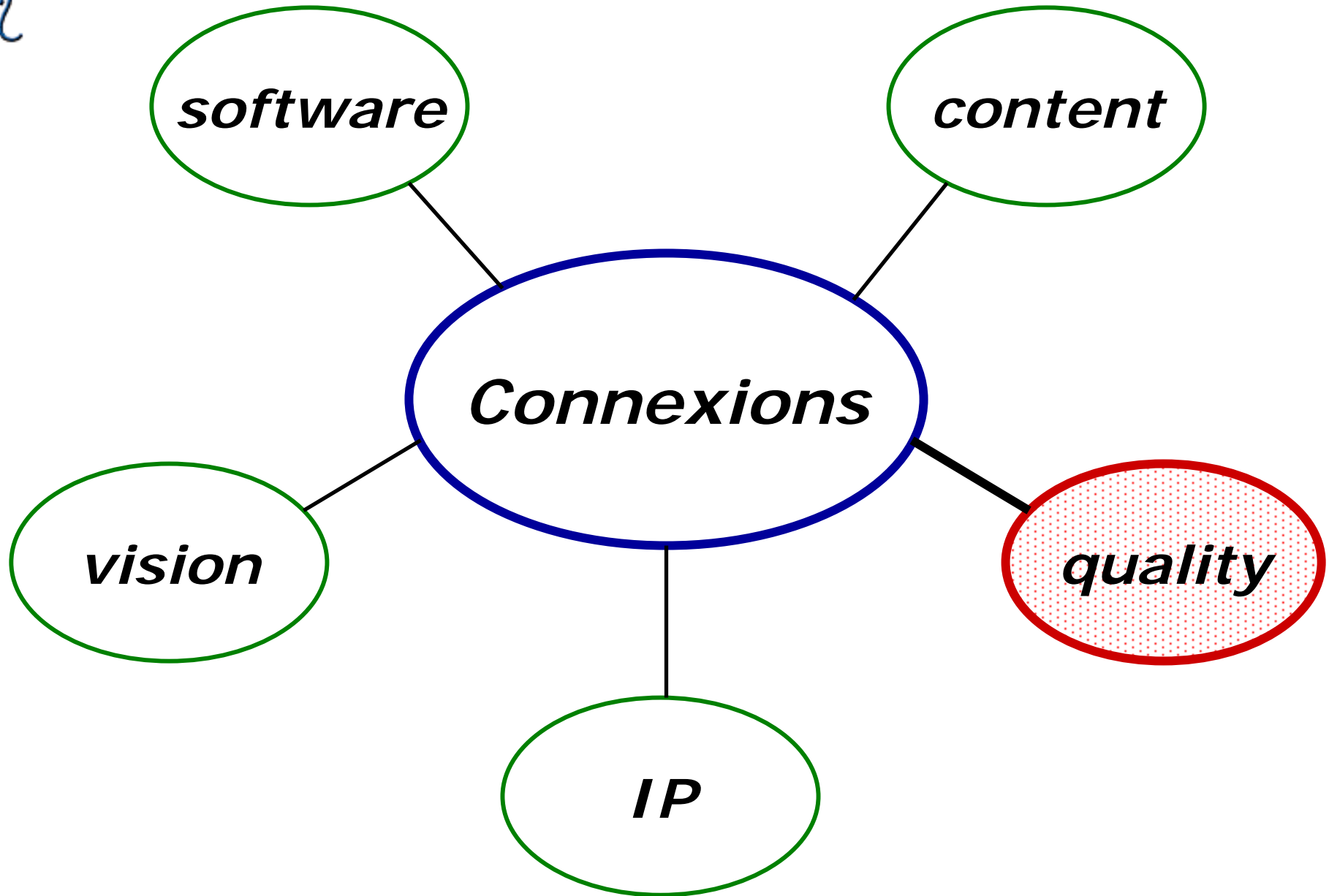


*creativecommons.org*



# Open Content Licensing

- Recent developments
  - Berlin Declaration (EU) (October 2003)
  - Public Library of Science
  - MIT OpenCourseWare
  - Peru, Brazil, Argentina, Mexico open-source initiatives
- Commercial collaborators
  - Kinkos, Cambridge University Press, National Instruments*
- Sharing, (re)use requires that IP be *integrated* into content





# Quality Assessment

- Requirements:
  - *evaluate* and *credential* modules and courses
  - *direct* users to high-quality materials
- Standard approach: *pre publication peer review*
  - suitable when publication medium is scarce
  - costly and slow
  - exclusive rather than inclusive
  - *not scalable* to evolutionary development
  - does not support evaluation based on actual student learning in the field



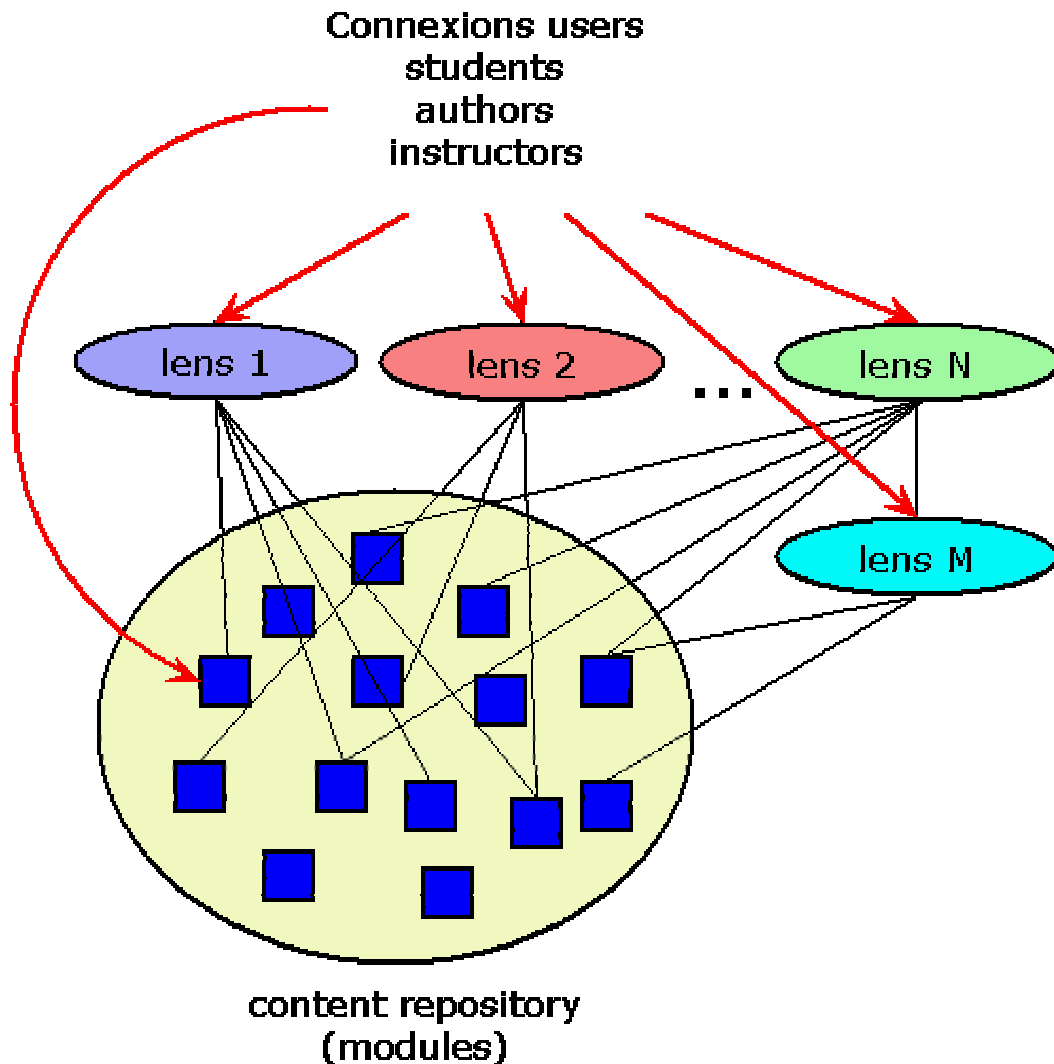
# Post-publication Review: *Lenses*

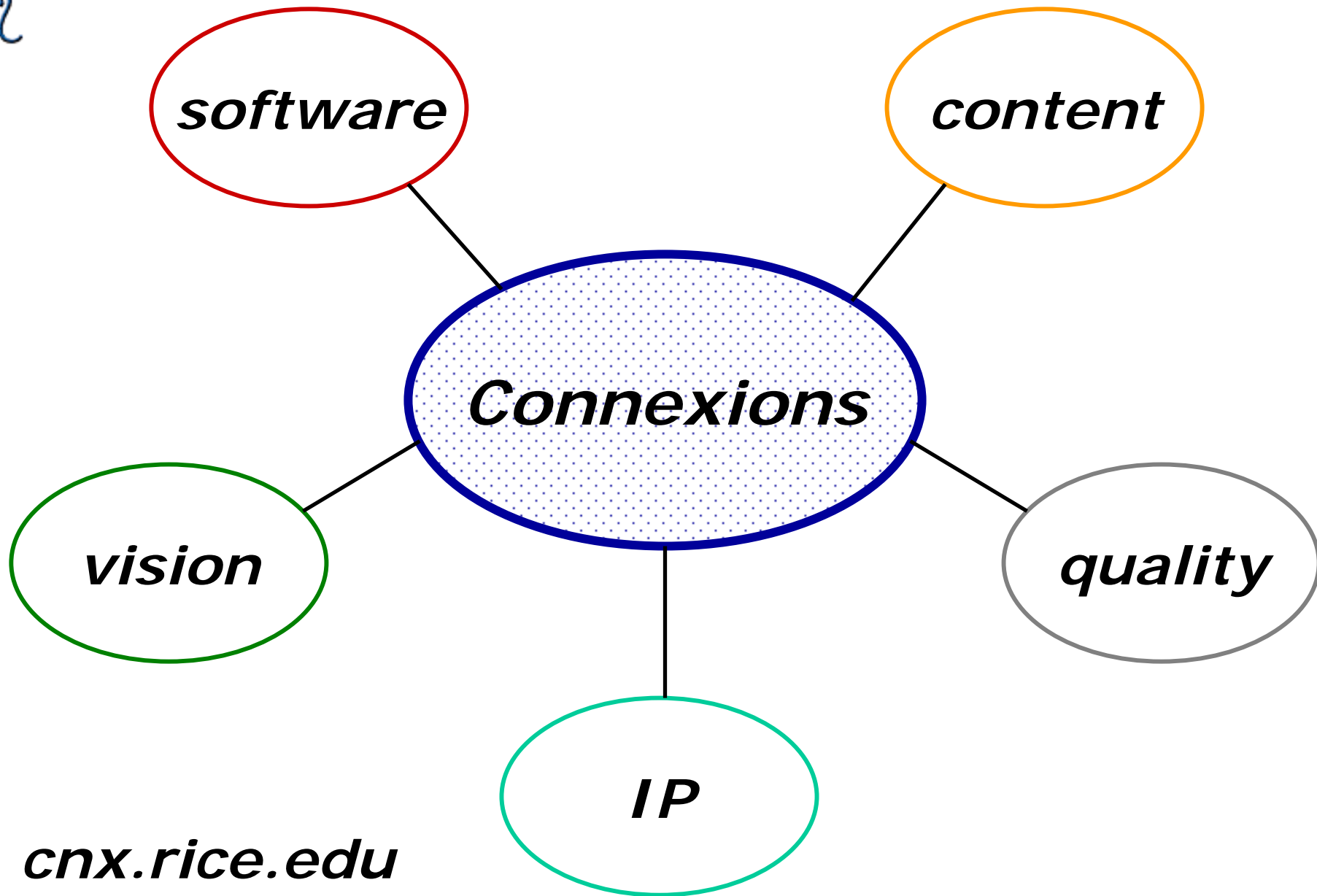
- *Distributed* peer review
- Distributed “consumer’s guide”
- View modules/courses through *lenses* (filters)
- Each lens has its own *focus*
- Lenses provided by *3<sup>rd</sup> parties*

Professional society  
University, School board  
Publisher, Colleagues

Most popular, linked  
Collaborative filtering  
User rating

Learning assessment rating





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# Core – Plan and Timeline

## **Proof-of-Concept Phase** 1999-2004

- Release 1.0 (February 2004)
  - robust, fully documented, *open-source* tools
  - collaborative authoring, roadmap, annotation, publishing, ...

## **Build-up Phase** 2004-2007+

- expanded outreach, training to support *grassroots dev.*
- enhanced tools to promote *scaling*
- Release 2.0 (July 2004)
  - integrated open-source XML/MathML editor; MS Word converter
- Release 3.0
  - distributed data bases, multi-license, multi-language, lenses, ...

## **Sustainability Phase** 2007+

- *support* infrastructure
- non-profit, "*dot-org*"



# Connexions Team

- **Faculty**
  - Richard Baraniuk, Sidney Burrus, Don Johnson, Chris Kelty, Bill Wilson
- **Executive Director**
  - Geneva Henry
- **Software and Content Development Staff**
  - J. Cameron Cooper, Jennifer Drummond, Adan Galvan, Brent Hendricks, Mark Husband, Charlet Reedstrom, Ross Reedstrom, Max Starkenburg, Brian West
  - ~10 undergraduate students
- **Usability and Assessment**
  - Janice Bordeaux, David Lane, Minmin Yang
- **Sustainability Planning**
  - Steve Currall, Paul Dholakia



# Connexions is *Open to You!*

- We welcome your participation
  - Author
  - Instructor
  - Editor
  - Learner
  - Organizer ...



# To Learn More

- Connexions web site: **[cnx.rice.edu](http://cnx.rice.edu)**
- Contact: **+1.713.348.3674**  
**[cnx@rice.edu](mailto:cnx@rice.edu)**