Center for LifeLong Learning & Design

University of Colorado at Boulder

Wisdom is not the product of schooling but the lifelong attempt to acquire it.
- Albert Einstein

Knowledge Management (KM) — Problems, Promises, Realities, and Challenges

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Knowledge Management

- **knowledge management** = definitions:
    - use of technology to make information relevant and accessible wherever that information may reside (see Brown&Duguid, p 117)
    - finding effective ways to connect groups of people (Smith, R. G. & Farquhar, p 22)

- **questions to be asked of any KM approach:**
    - what are the methods that are available from your community to realize a KM approach?

    - what is the interaction between IT aspects and non-IT aspects? → e.g., which incentive structures are provided?

    - what are promising open research topics, both from a research point of view and from an industry point of view?

    - what are good/bad experiences that are made?

Xerox Advertisement

- **ancient dilemma:**
    - "no one head is big enough to hold all the knowledge a business needs to know"

- **Xerox Solutions:**
    - "make it simpler to find, capture and the knowledge in your company"
    - "make sure that all your heads can work together"
    - "keep the conversation going — share the knowledge"

Lessons Learned

see: Smith, R. G. & Farquhar, p 27

- nurture a knowledge sharing culture

- while technology isn't everything …. little progress will be made without it

- build it and they won't come

- content (up-front investment → seeding)

- everyone is a potential contributor

- WIIIFM — What is in it for me? Now!

The Road Ahead

- first wave KM
    - technology: portals
    - process: best practice
    - people: communities of practice

- infrastructure:
    - e-business
    - XML
    - wireless devices

- JIT (just-in-time) knowledge delivery (agents, wizards)

- one stop search / cased-based reasoning

- knowledge representations

- knowledge-powered enterprise

- knowledge creation / innovation ("continuous learning")

Problems and Promises

- **closed system** → **open and evolvable systems** (seeding, evolutionary growth, reseeding model, open systems)

- **information** → **attention economy**
  - beyond information anywhere and anytime → saying the "right" thing at the "right" time in the "right" way to the "right" people
  - decontextualized information → making information relevant to the task at hand (critiquing)

- **complement information access** ("pull" technologies) with **information delivery ("push" technologies)**

- **individual** → **social:** how do we effectively collect individual knowledge and make it accessible to the entire organization?

Major Processes in Knowledge Management
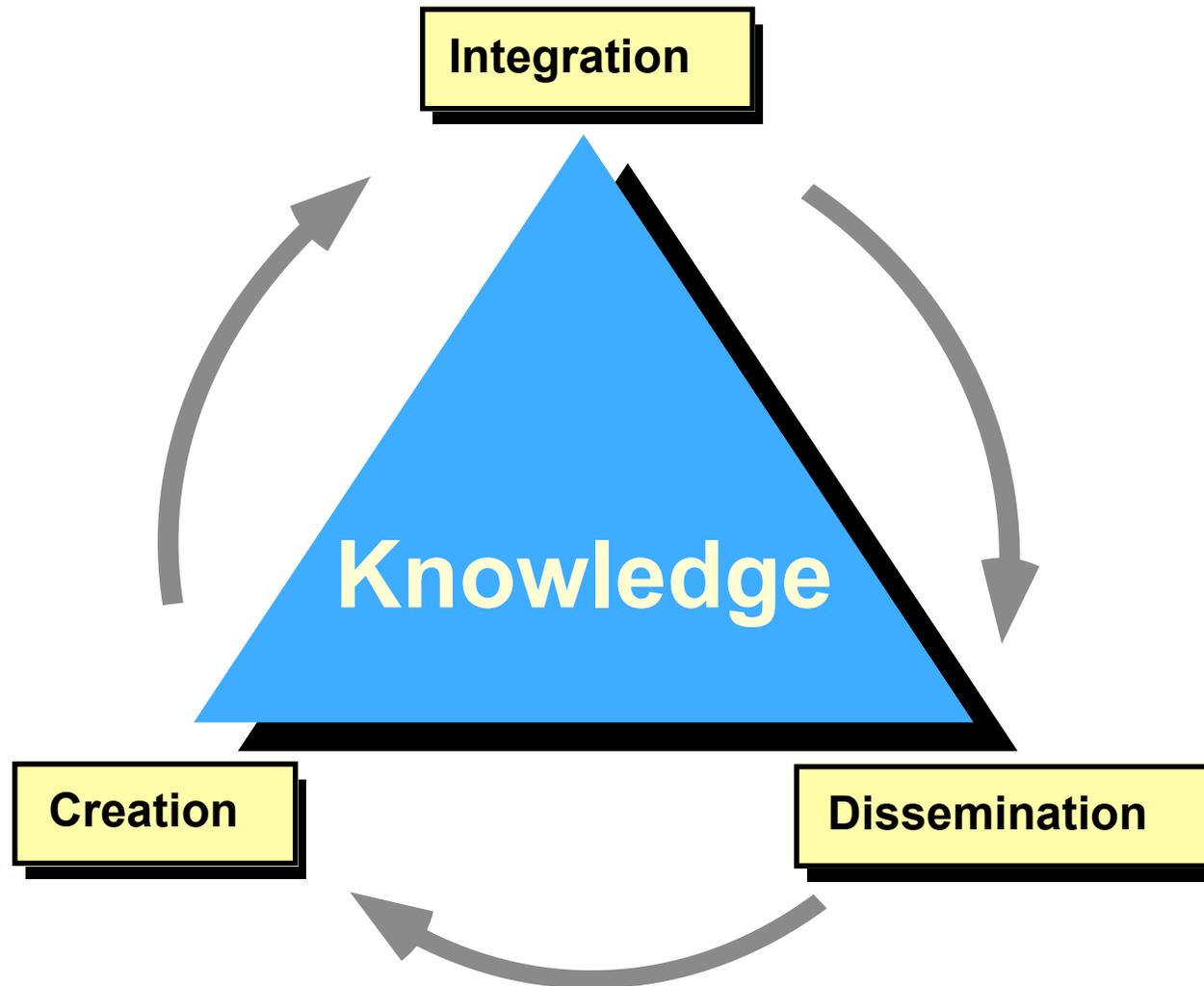
From Hardware and Software to Infoware
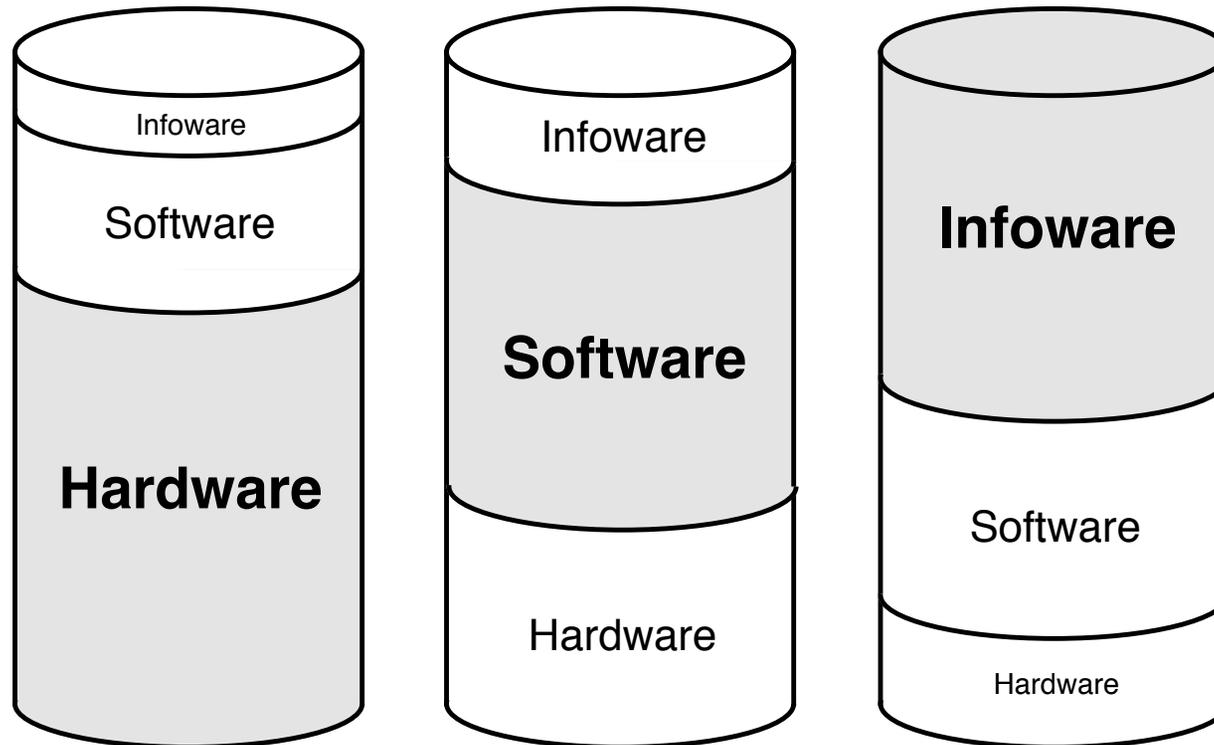
- **infoware = content of organizational memories serving KM:** reuse objects, best practices, design patterns, narratives, stories, experiences,………

The Unique Aspects of L3D's Approach

- **traditional KM approaches:**
  - **aim:** to archive information from the past so lessons will not be forgotten
  - **implication:** the information needs of the future will be the same as they were in the past.

- **focus of L3D's approach:**
  - knowledge is not a commodity to be consumed but is a **collaboratively designed and constructed artifact**
  - **human-centered** — focusing not on knowledge as information stored in repositories, but rather on a continual process in which knowledge is
    - * created as a by-product of work
    - * integrated in an open and evolving repository
    - * disseminated to others in the organization when it is relevant to their work
  - information repositories are **"living"** (open and evolving) entities (see Dynasite Guest lecture)
 - **domain-orientation**

Contrasting two Different Views of KM

	traditional perspective	our perspective
creation	specialists (e.g., knowledge engineers)	everyone (e.g., people doing the work), collaborative activity
integration	at design time (prior to system deployment)	at use time (an ongoing process)
dissemination	lecture, broadcasting, class-room, decontextualized	on-demand, integration of learning and working, relevant to tasks, personalized
learning paradigm	knowledge transfer	knowledge construction
tasks	system driven (canonical)	user/task driven (situated)
social structures	individuals in hierarchical structures, communication primarily top-down	communities of practice; communication primarily peer-to-peer
work style	standardize	improvise
information spaces	closed, static	open, dynamic
breakdowns	error to be avoided	opportunities for innovation and learning

Overview of L3D's Approach

	Knowledge Creation	Knowledge Integration	Knowledge Dissemination
Key Idea	knowledge is a product of work, rather than an existing commodity	new knowledge is integrated into repositories at use time, by workers	workers are informed in the context of work, rather than in classroom
Problems	creating understanding the role of externalizations to create (shared) understanding	putting workers in charge users must be empowered to manage their own information (and environments)	information overload the limiting resource for knowledge work is not information, but attention
Promises	social creativity workers are informed participants, rather than consumers of pre-packaged information	living organizational memory information repositories are evolved by unselfconscious cultures of design	attention economy information is delivered to workers when it is relevant to their specific needs
Realities	**EDC / PitaBoard** boundary objects support communities of interest to build shared understanding	**DynaSites** open information spaces evolved by users with system support for integration	**DODEs, CodeBroker** design tools and information repositories are integrated to enable knowledge delivery

Knowledge Capture: Embedded Communication

Designing

Communicating

Computer stores
the artifact

Computer mediates
design and communication
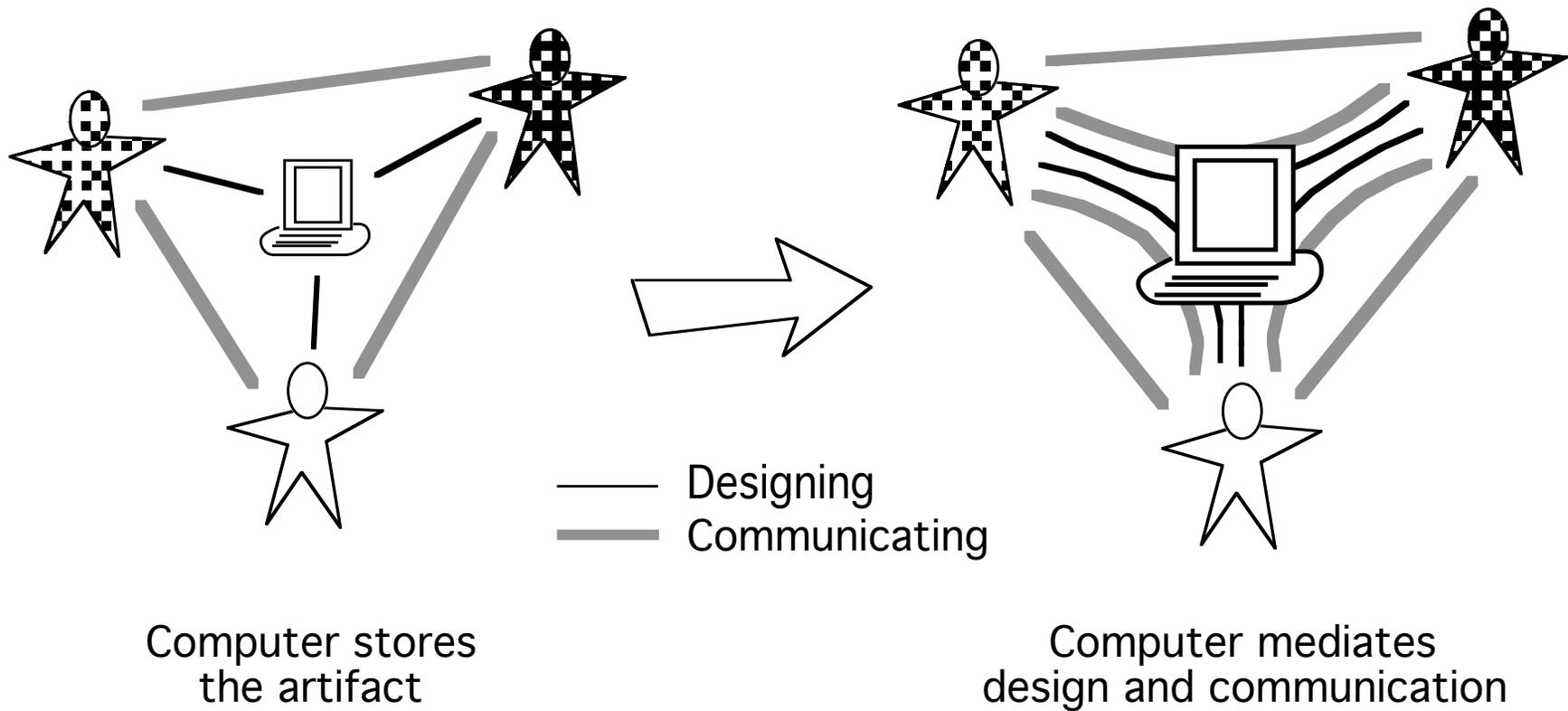
DynaSites Information Spaces: Living, Linked and Dynamic
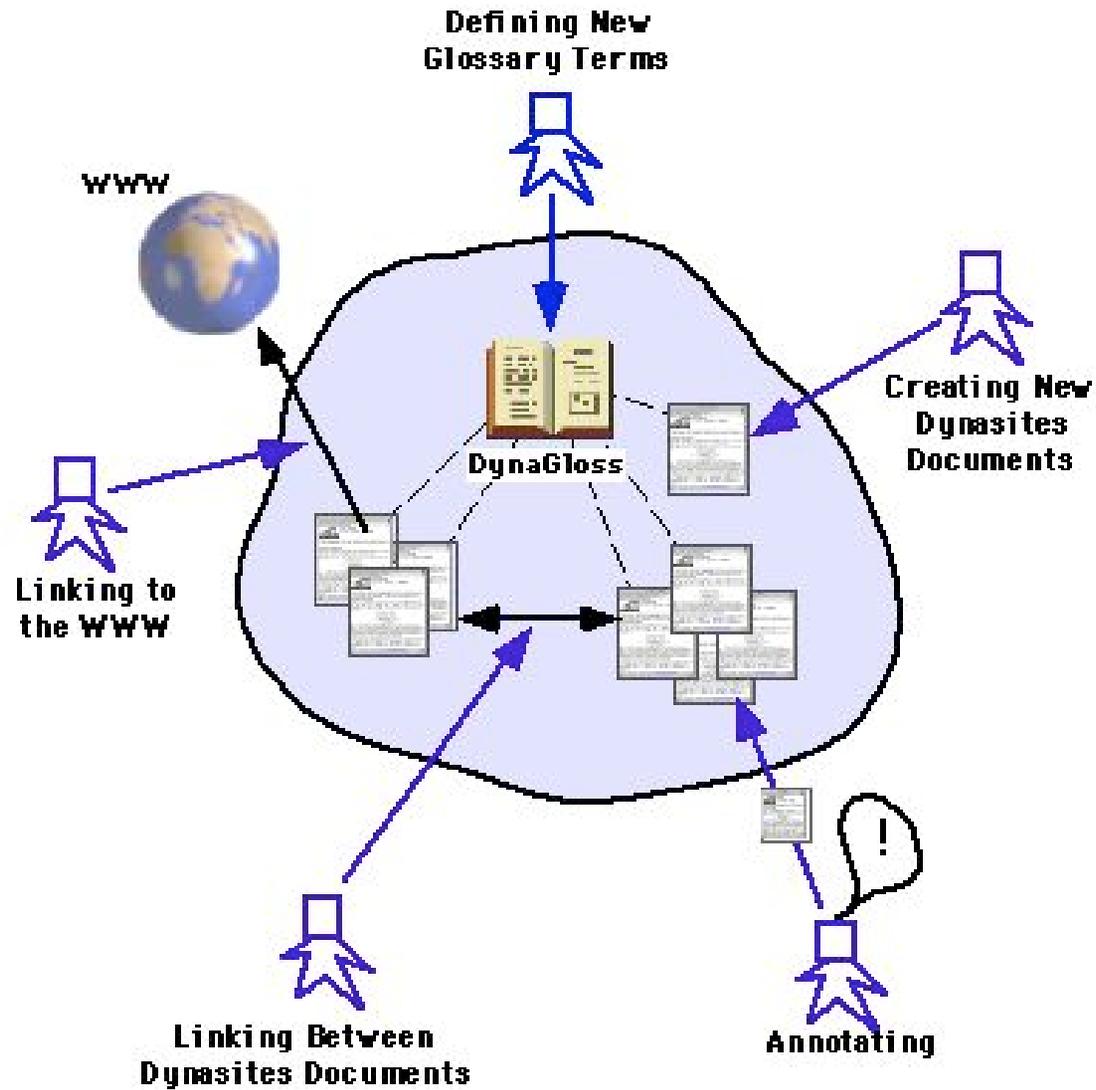
"Open Source" and "Open Systems"

- **an intellectual paradigm requiring a new mindset**
  - objective: leverage is gained by engaging the whole world as a talent pool
  - from users/consumers → co-designers/active contributors

- **some examples of decentralized, evolvable information repositories**
  - open source: collaborative development of software
  - the scientific method/enterprise itself
  - insight: *"software/knowledge is not a commodity to be consumed but is a collaboratively designed and constructed artifact"*

- **some characteristics:**
  - evolutionary design of complex systems
  - success stories so far: technically sophisticated developers not end-users

Social Capital

- the incentive to be a good colleague, to contribute and receive knowledge as a member of a community (see Expert Exchange, the scientific community, the open source community)

- **hacker milieu (and academia) as gift culture:** human beings have an innate drive to compete for social status
  - in gift cultures, social status is determined not by what you control but by *what you give away*
  - prestige is a good way (and in a pure gift economy, the *only* way) to attract attention and cooperation from others
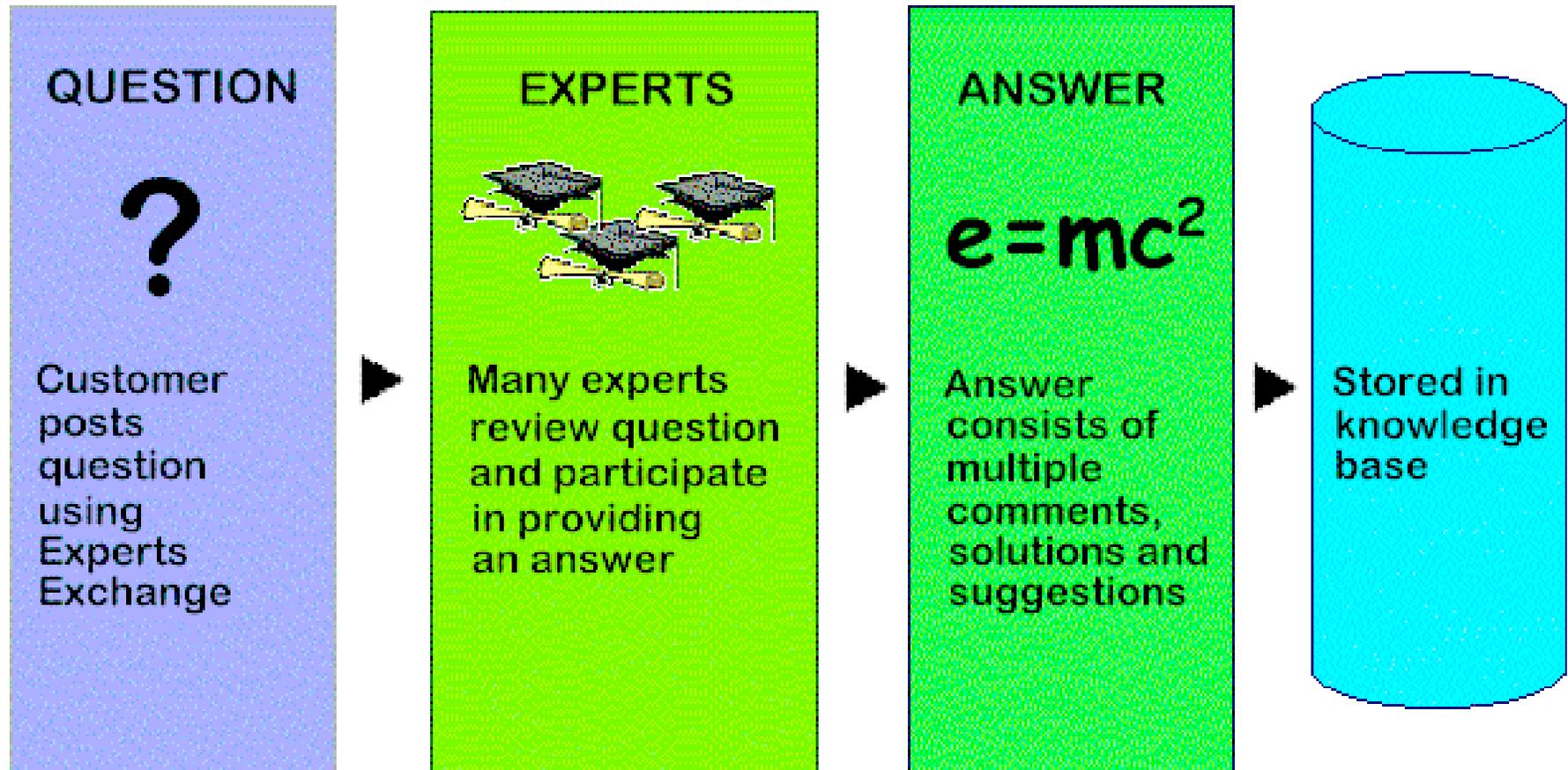 - *"utilization is the sincerest form of flattery"*

- **more information:**

Gerhard Fischer, Eric Scharff and Yunwen Ye: "Fostering Social Creativity by Increasing Social Capital", in Social Capital, Marleen Huysman and Volker Wulf (Eds.) (in press) [http://www.cs.colorado.edu/~gerhard/papers/social-capital-2002.pdf]

Experts Exchange — Filling the Knowledge Gap

http://www.experts-exchange.com

QUESTION

?

Customer posts question using Experts Exchange

▶

EXPERTS

Many experts review question and participate in providing an answer

▶

ANSWER

$e=mc^2$

Answer consists of multiple comments, solutions and suggestions

▶

Stored in knowledge base

The Virtual Knowledge Community behind the Experts Exchange

- **some common elements:**
  - an incentive structure
  - an economy including a currency for exchange
  - the accumulation of wealth and status
  - dealing with anti-social behavior
  - construction of identity

- **the economy of Experts Exchange:**
  - is based on knowledge, with credits used as currency
  - with a limited supply of credits available, the invisible hand of free markets is used to allocate the knowledge available
  - wealth is measured as the accumulation of knowledge credits

- **what's in it for the experts?**
  - the experts are the heart of Experts Exchange, which was created by and for experts → *at Experts Exchange you become an expert solely by answering questions well*
  - **benefits:**
    - * *recognition — by accumulating points an expert obtains tangible evidence of their expertise, that can be used in resumes or letters of recommendation*
    - * *potential compensation — service is free; however, we expect that as our customer base grows we will obtain some commercial customers who will be delighted to pay our very reasonable rates*

Some Knowledge Management Myths

- **myth-1: knowledge is a commodity** → *"we can simply 'capture' the knowledge of a thirty-year expert in explicit form so we can fire the expert and hire someone with no relevant skills off the street who can now use the 'knowledge base' to perform like an expert"*
  - → **collaborative knowledge construction**

- **myth-2: self-organizing evolution** → *"informed participation leads to evolutionary growth and large information repositories which will be self-organizing"*
  - → **reseeding**

- **myth-3: information is a scarce resource** → *"access to information anytime and anywhere will solve a key KM problem"*
  - → **say the 'right' thing at the 'right' time in the 'right' way**

Myth$_2$: Self-organizing evolution
—
Information Repositories Evolved by Specialists versus Evolved in the Working Context

	evolved by specialists	evolved in the working context
examples	digital library of ACM	websites of communities of practice, Eureka
nature of individual entries	database like entries	narratives, stories
economics	requires substantial extra resources	puts an additional burden on the knowledge workers
delegation	possible in domains in which entries/objects are well-defined	problem owners need to do it, because the entries/objects are emerging products of work
design culture	self-conscious	unself-conscious
motivation	work assignment	social capital

Comparison of Information Access ("Pull") and Delivery Approaches ("Push")

|	access ("pull")	delivery ("push")
examples	passive help systems, browsing, search engines in WWW, bookmarks	Microsoft's "Tip of the Day", broadcast systems, critiquing, active help systems, agent-based systems
strengths	non-intrusive, user controlled	serendipity, creating awareness for relevant information, rule-enforcement
weaknesses	task relevant knowledge may remain hidden because it couldn't be specified in query	intrusiveness, possibility of decontextualized information
major system design challenges	supporting users in expressing queries, better indexing and searching algorithms	context awareness (intent recognition, task models, user models, relevance to the task-at-hand)

Realities based on Assessment Studies

- **KM: new technology is necessary, but not sufficient** → change of work practices, mindsets and reward structures is necessary
    - design rationale research
    - reuse versus "not invented here"
    - media competition

- **motivation for a group is different than for an individual**
    - "who is the beneficiary and who has to do the work?"
    - *utility = value / effort*

- **engage skilled professionals in realistic work situations**
    - requires useful and usable systems (not just demo systems)
    - prerequisite for evolutionary growth

Experiences from Industry

- **Xerox** — Eureka (an information repository of useful knowledge for copier repair representatives, created and evolved by the users themselves, subject to peer review, believed to save the company up to $100 million a year, participants build social capital and recognition among peers)

- **Netscape** — open source (decentralized development) and Mozilla (centralized integration) → see relationship to "seeding, evolutionary growth, and reseeding" model

- **DaimlerChrysler Research, Ulm** — Experience Factory for Software Reuse

- **Nynex, White Plains** — Gimme, Knowledge Depot (group memories)

- **IBM, Global Services, Boulder** — 1200 Help Desk People

Example: 1200 Help Desk People

- broadcasting leads to information overflow of decontextualized information
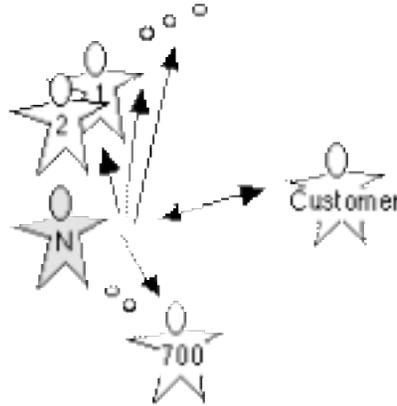
- the challenge: supporting the integration of working and learning, learning on demand
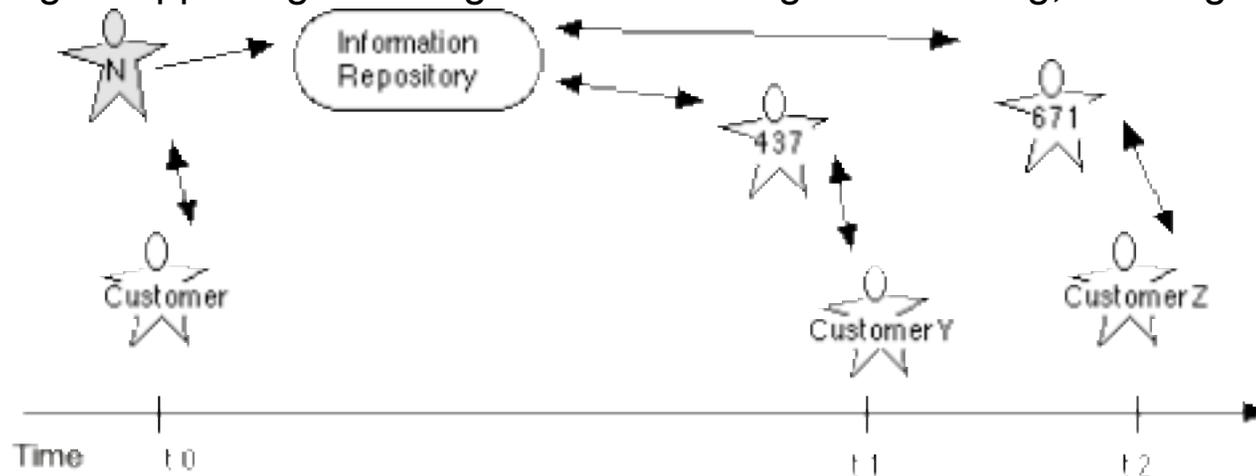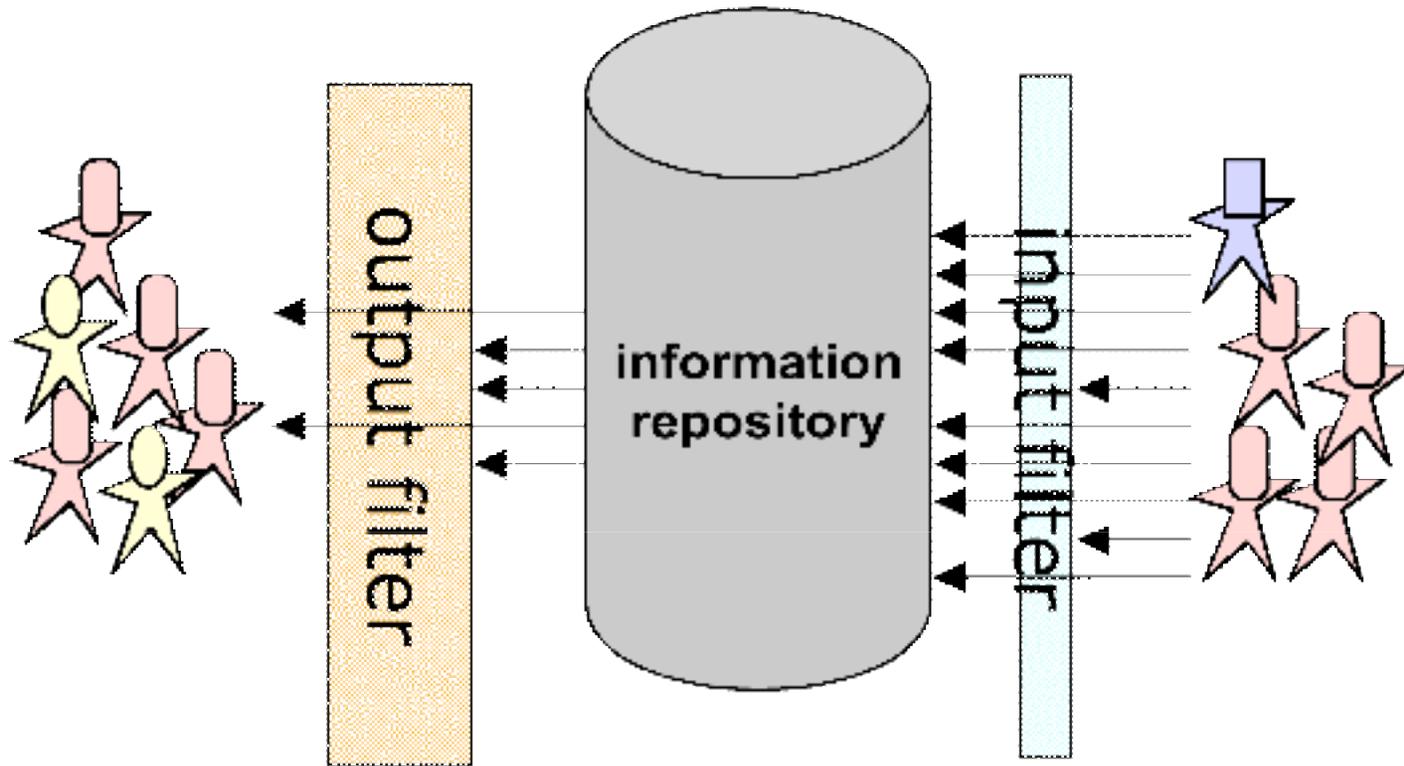
Producer/Consumer Models in a **Consumer** Culture ("Access"):
Strong Input Filters, Small Information Repositories, Weak Output Filters

key: designer, active user, passive user
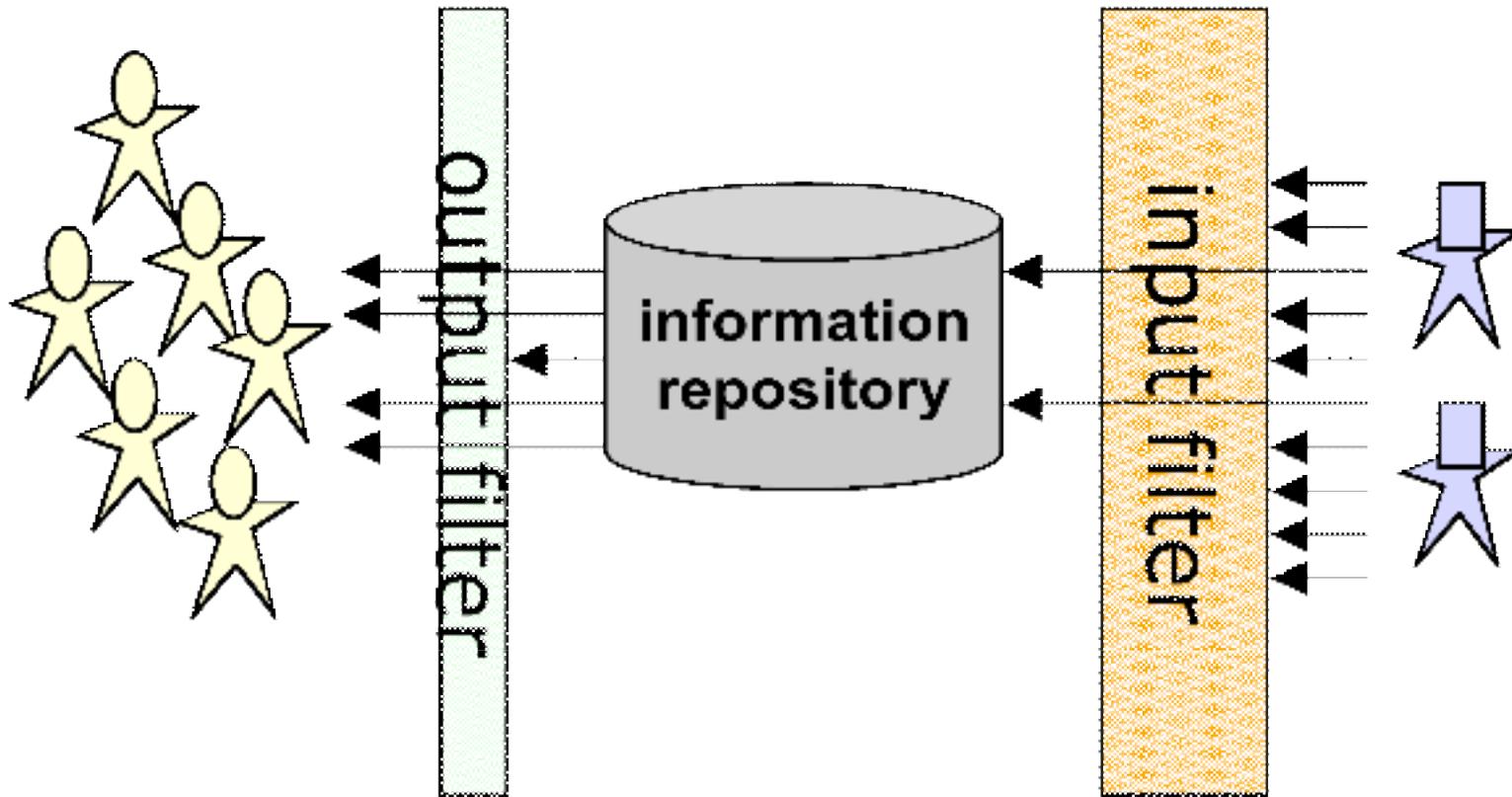
Limitation: Making All Voices Heard

Design Culture ("Informed Participation"):
Weak Input Filters, Large Information Repositories, Strong Output Filters

Limitation: Trust and Reliability of Information

Reality: Collaborative Systems — More Than New Technologies

- **"collaborative systems will not work in a non-collaborative society"**
  - a student's observation in one of our classes using organizational memories to enhance peer-to-peer learning, sharing of information, self-evaluation, etc.
  - question: what will make people want to share? → will require: culture change, new mindsets, new reward systems

- **"the paradise of shared knowledge isn't just happening. Knowledge isn't shared because management does not want to share authority and power"** (Zuboff "The Age of the Smart Machine", 1988)

Sharing Versus Hoarding Knowledge