Doug Engelbart's Unfinished Revolution—
Program for the Future

Lecture 4
Doug's Core Technical Ideas

Dino Karabeg

This seminar begins with a riddle...

The inventor who marked the computer age

ended his life feeling that only a small part ("3.6%") of his vision and ideas had been understood and implemented in practice

What's the remaining

96.4%

Program for the Future Challenge
Launched Dec. 9, 2013 at Googleplex

This seminar will explore

- Doug's core ideas and
- their contemporary extensions in order to
- create a perspective on the future of informatics
- and its potential to positively impact society

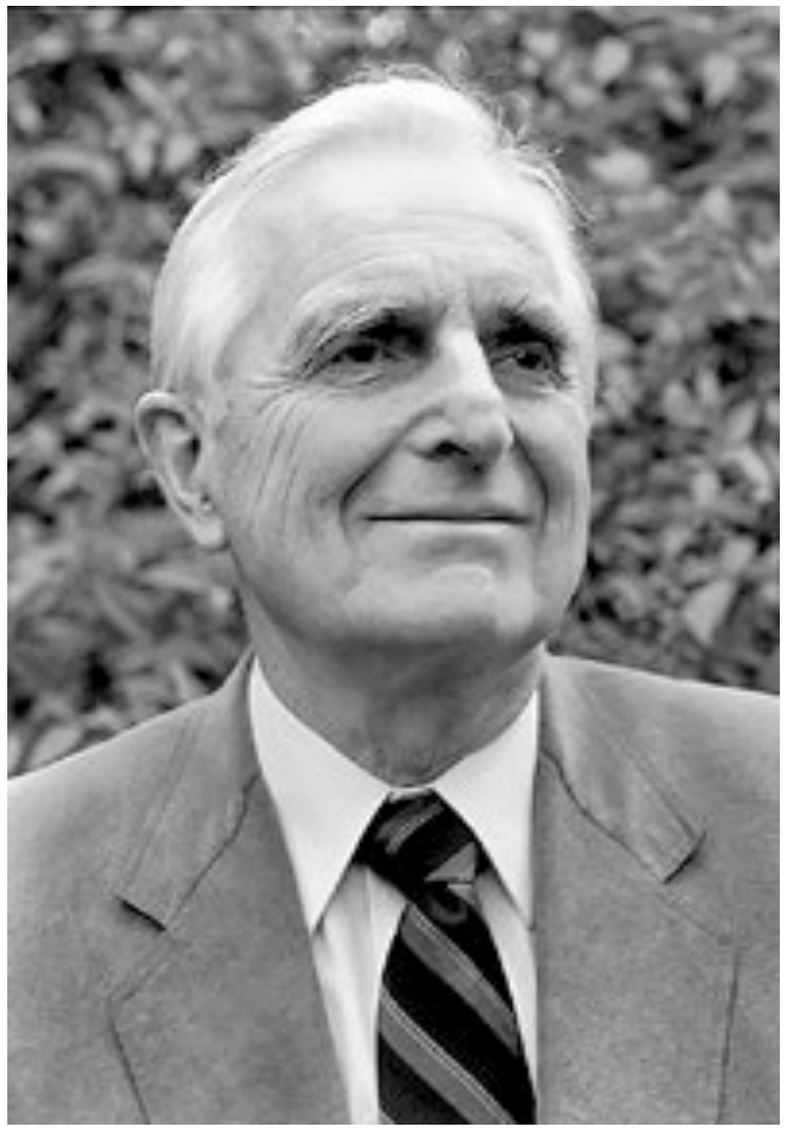
We will

- study Doug's not yet implemented ideas
- join an international project to complete them
- begin to develop projects of our own

Timeline

- historical introduction
- 1962 report & 1968 demo
- Doug's main insight
- Doug's core technical ideas

Digital technology could help make this a better world.



But we've also got to change our way of thinking.

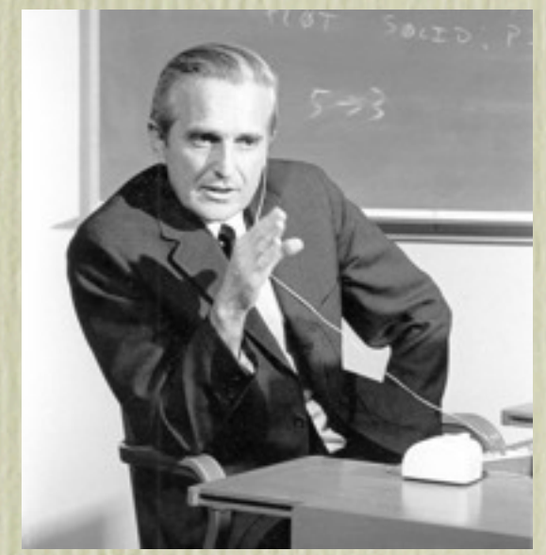
Doug's main insight

~~Automation?~~

Augmentation

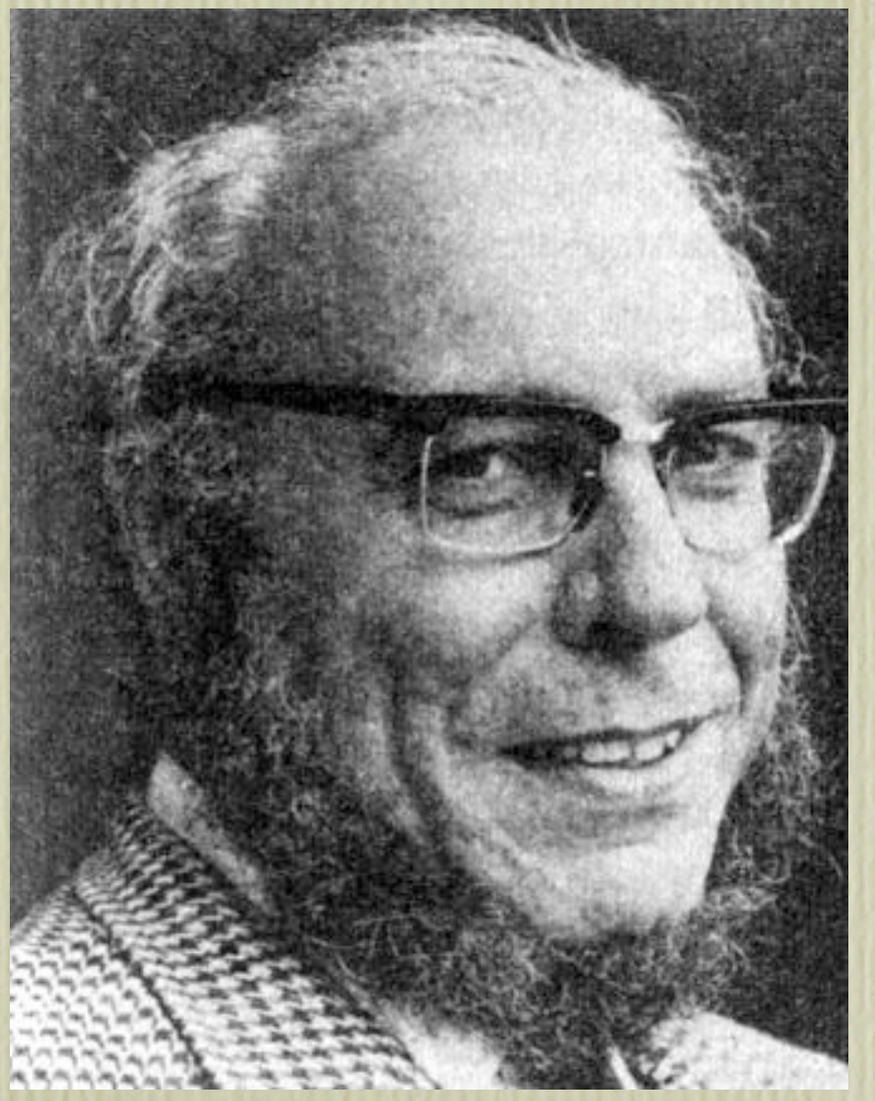
Doug was not alone

Vannevar Bush



Doug Engelbart

Marshall McLuhan

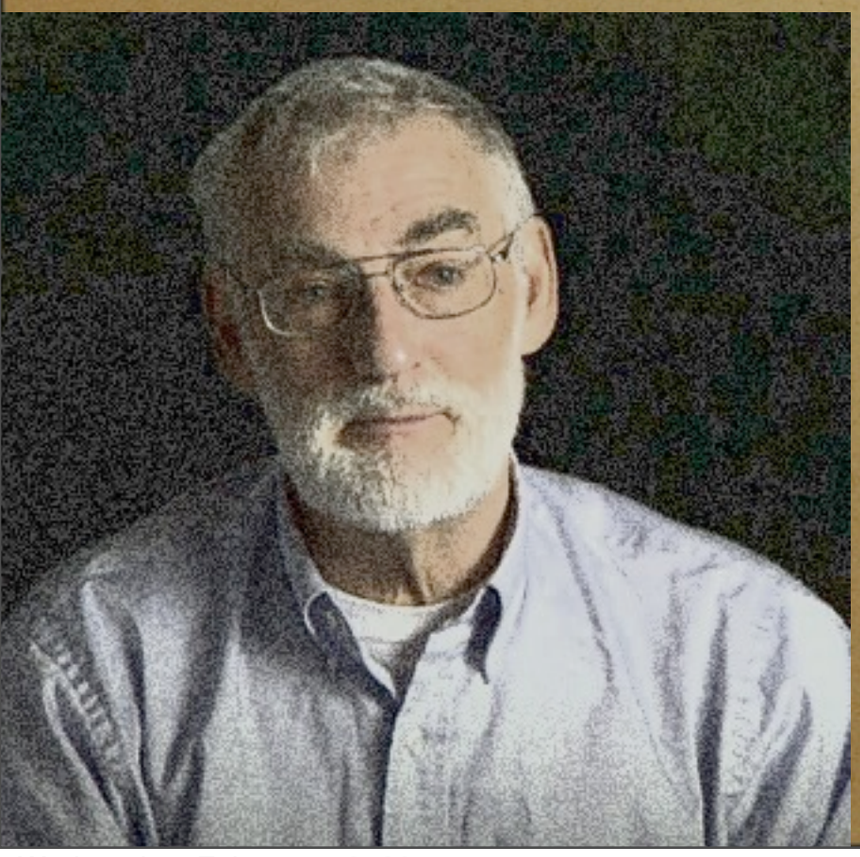


Erich Jantsch

The task is nothing less than to build a new society and new institutions for it. With technology having become the most powerful change agent in our society, decisive battles will be won or lost by the measure of how seriously we take the challenge of restructuring the “joint systems” of society and technology [...].

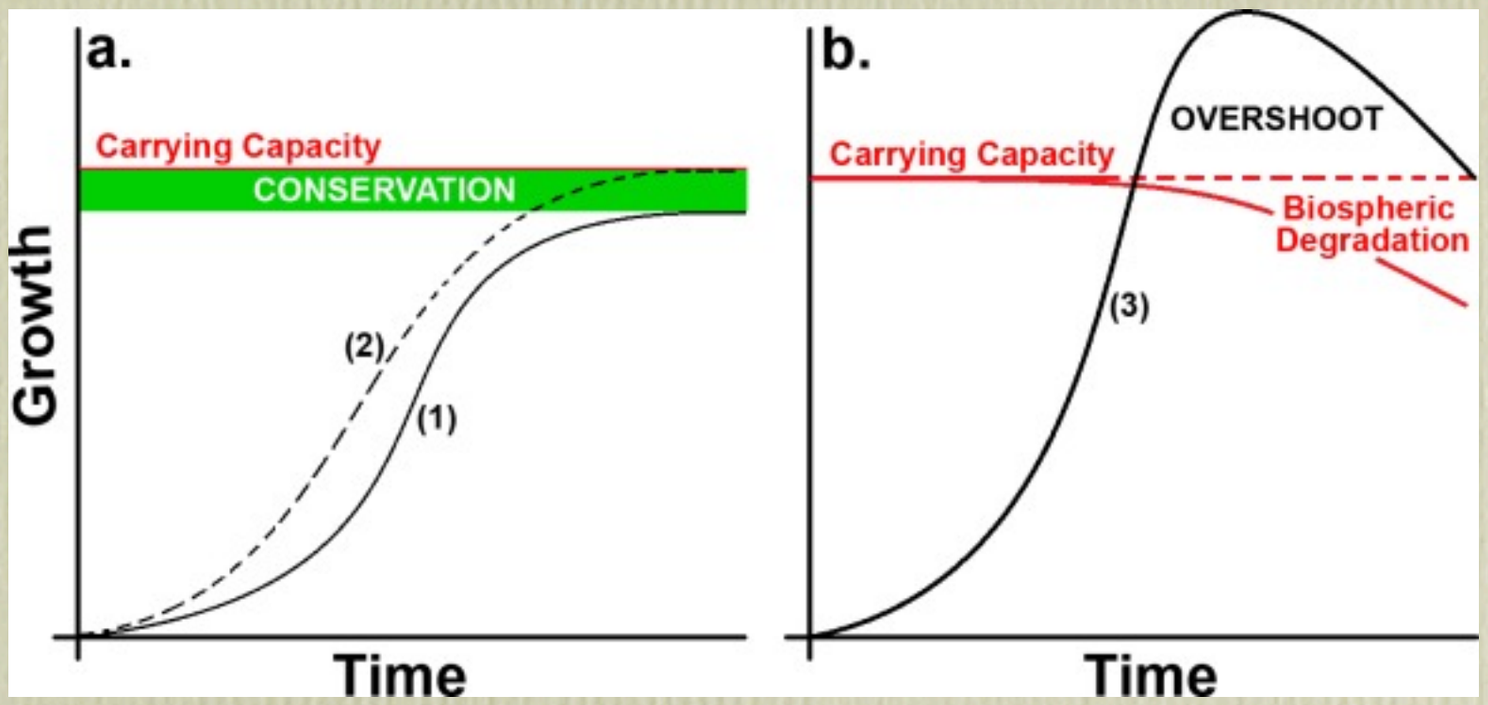
(Erich Jantsch, MIT 1969)

Bringing this down to Earth: An Example

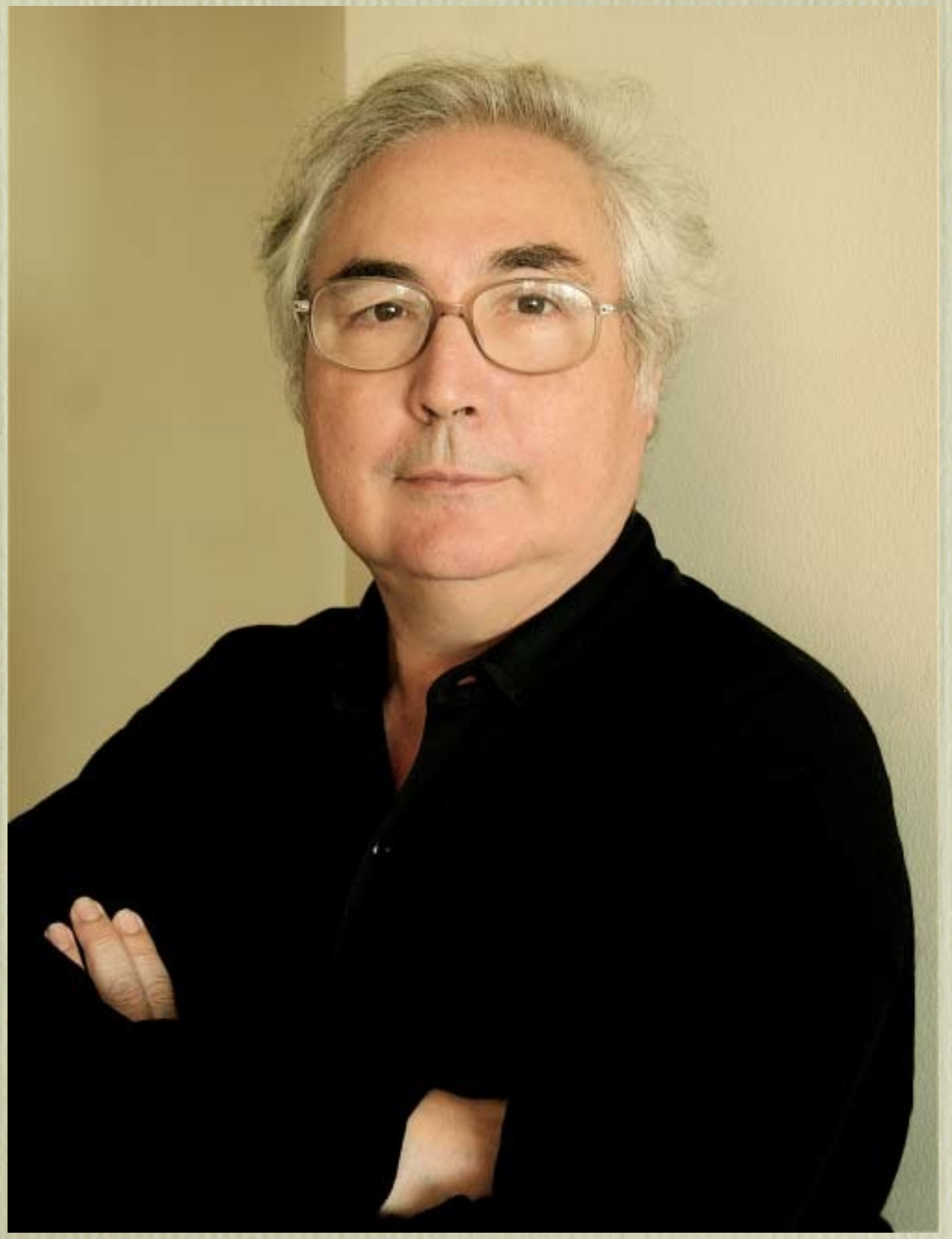


Dennis Meadows: It is too late for sustainable developement

Smithsonian 2012



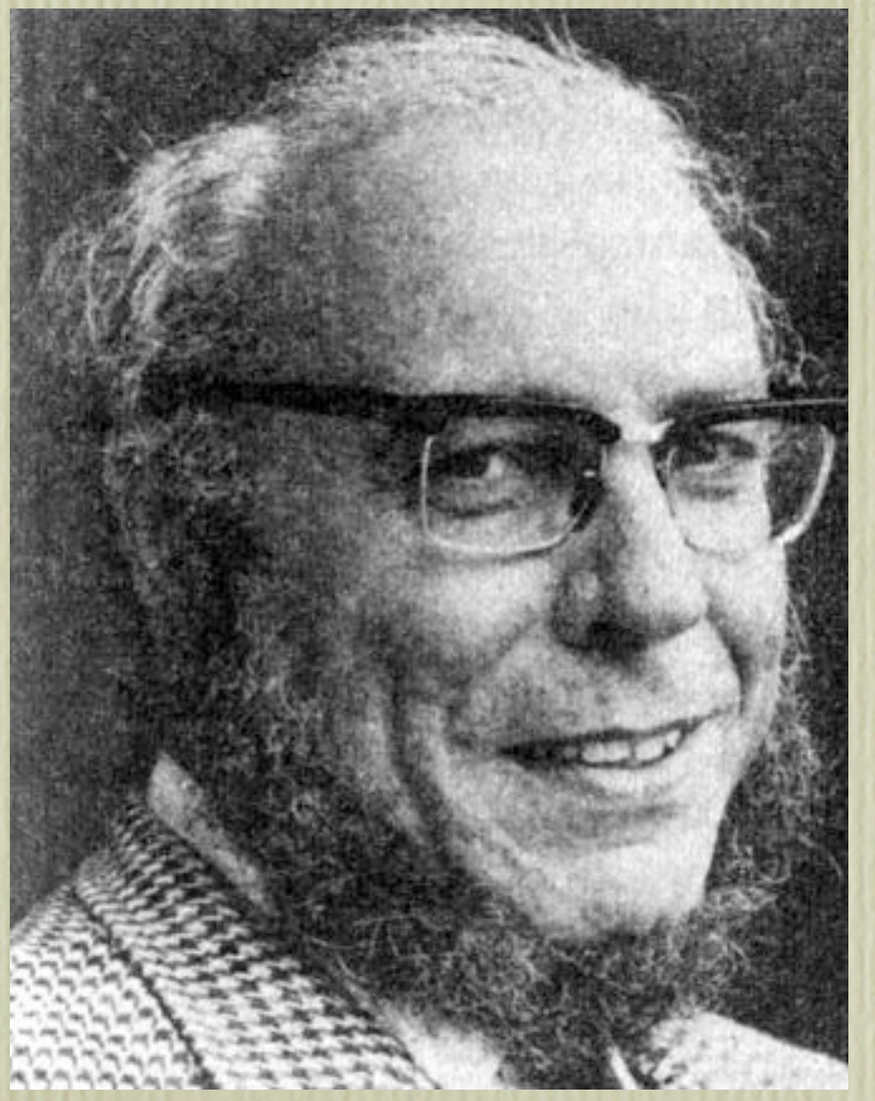
Sustainable (a) and non-sustainable (b) growth



Manuel Castells

The outcome of this process of financial globalisation may be that we have created an Automaton, at the core of our economies, decisively conditioning our lives. Humankind's nightmare of seeing our machines taking control of our world seems on the edge of becoming reality – not in the form of robots that eliminate jobs or government computers that police our lives, but as an electronically based system of financial transactions.

(Manuel Castells, 2001)



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We are developing an augmentation system for the systems community

Impacts for Sustainability: Epistemology & Research Activism

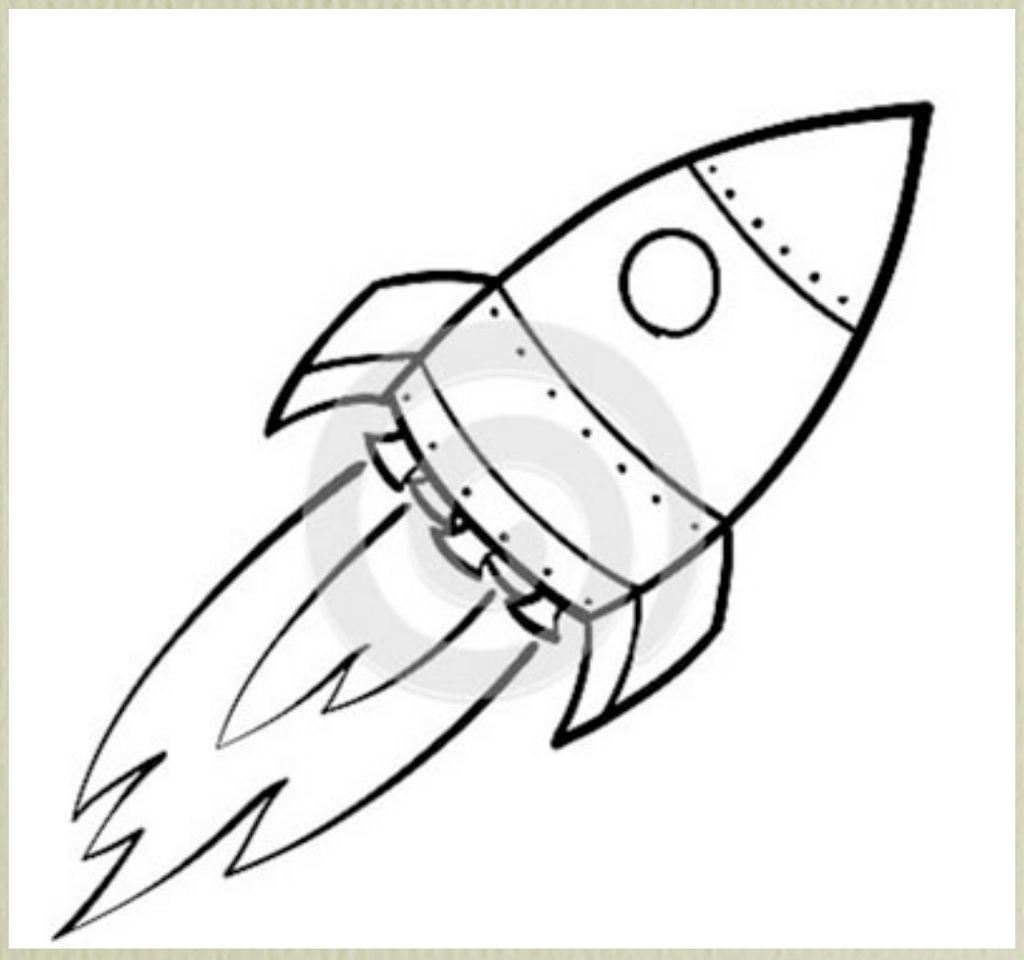
Symposium design draft

Join us in making a breakthrough on three related frontiers:

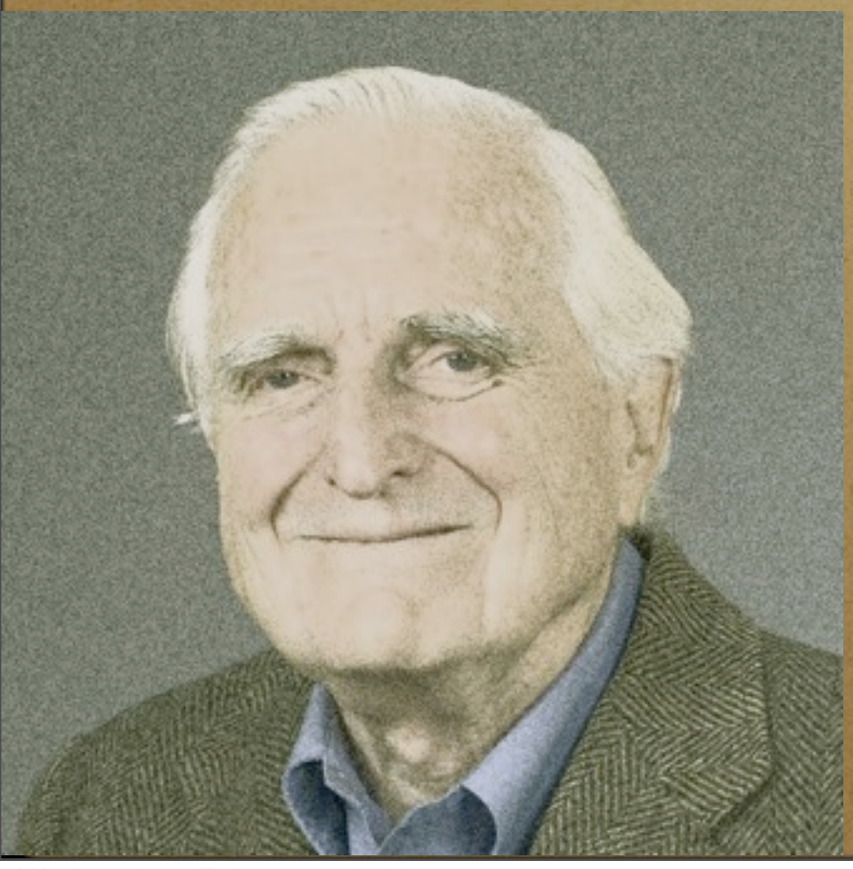
- Sustainability or thrivability
- Social impact of systems sciences
- Knowledge federation

The Impact for Sustainability: Epistemology & Research Activism symposium at the EMCSR 2014 in Vienna, where with your help we will initiate this breakthrough, will consist of two 1.5 hour events: a Dialog where we shall co-create a shared vision; and a World Cafe where we shall begin to realize this vision in practice.

Our augmentation system is structured as a three-stage rocket...



We let Doug himself introduce his core technical ideas



Authors@Google: Doug Engelbart, 2007

Lecture recording

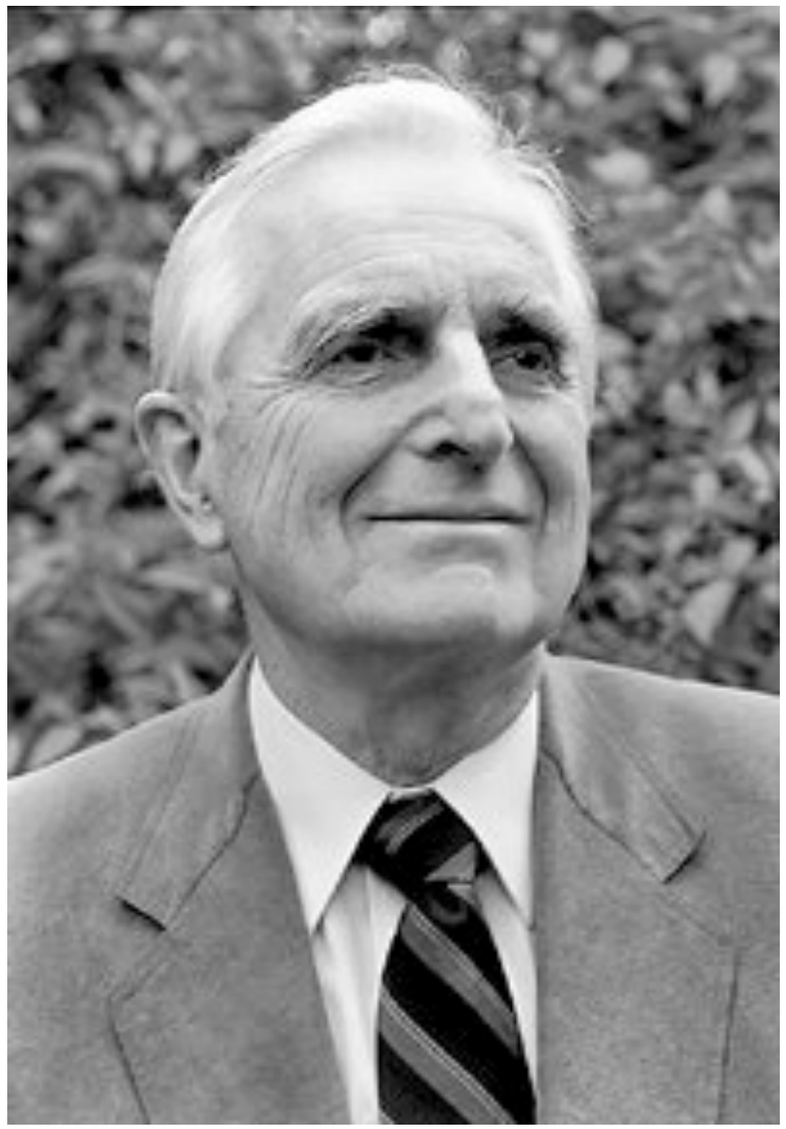
A Call to Action!

Google

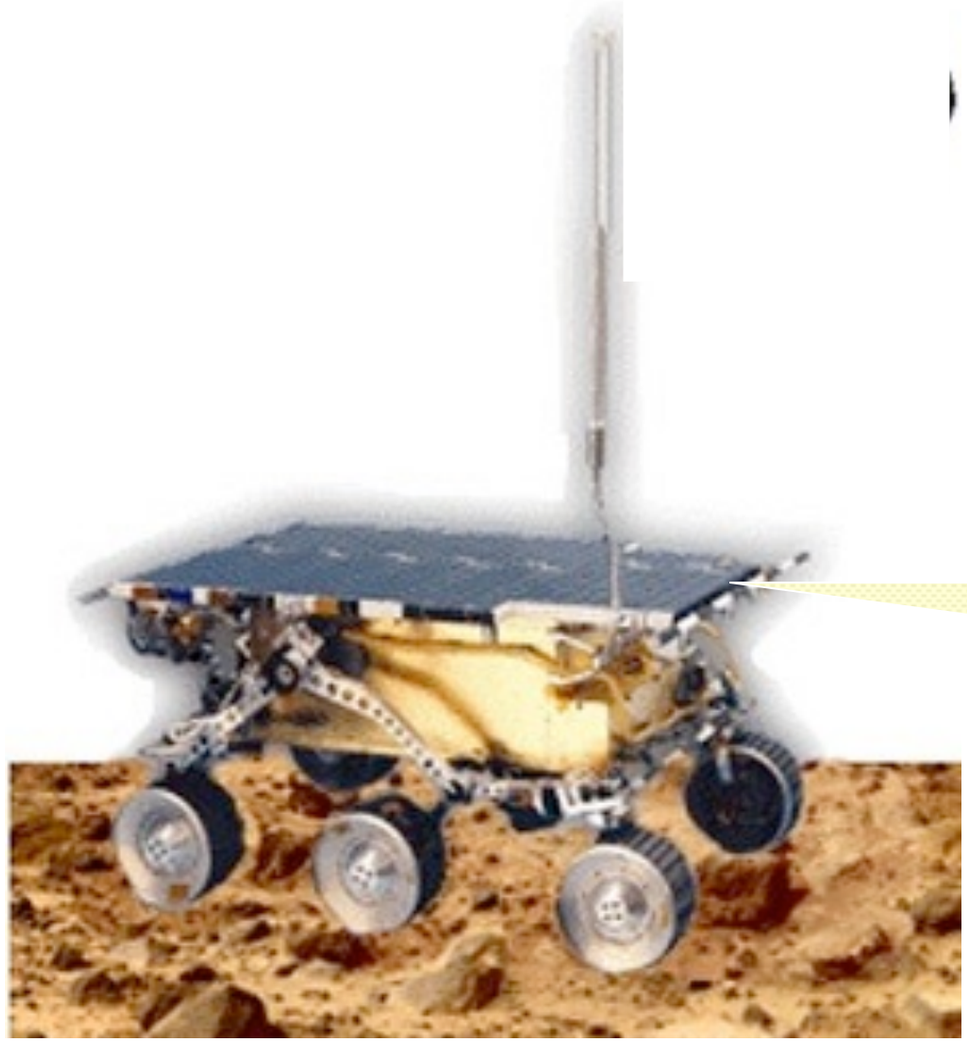
August 22, 2007

Douglas C. Engelbart
Peter Norvig
Vaughan Tan
Mei Lin Fung

Digital technology could help make this a better world.



But we've also got to change our way of thinking.



We ride a common economic-political vehicle

Traveling at an ever-accelerating pace through increasingly complex terrain.

Our headlights are much too dim and blurry

We have totally inadequate steering and braking controls.

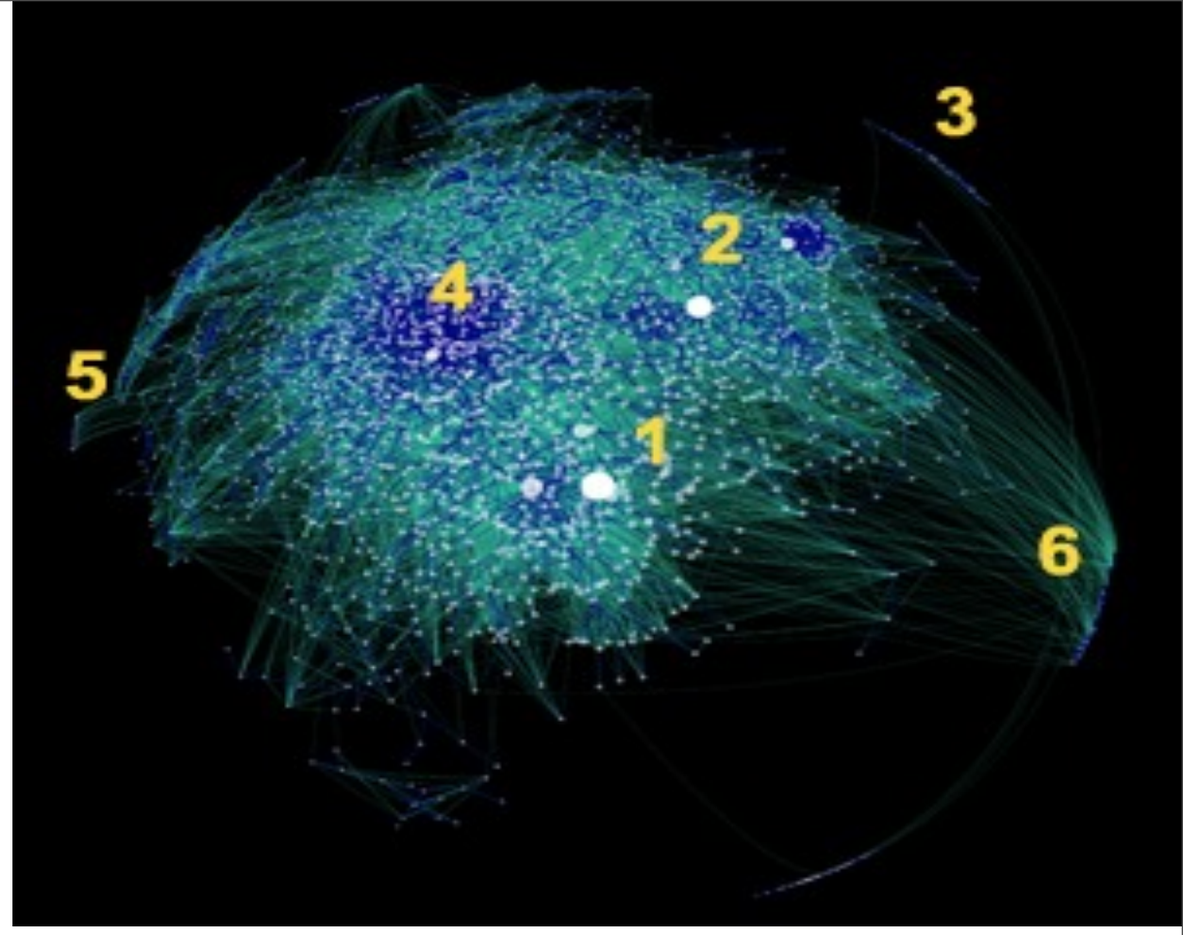
Many years ago, I dreamed that digital technology could greatly augment our collective human capabilities for dealing with complex, urgent problems.

Computers, high-speed communications, displays, interfaces--it's as if suddenly, in an evolutionary sense, we are getting a super new nervous system to upgrade our collective social organisms.

I dreamed that people could seriously appreciate the potential of harnessing that technological and social nervous system to improve the collective IQ of our various organizations.

I dreamed that we began to form cooperative alliances of organizations to develop and apply new collective knowledge.

I call these alliances NICs or Networked Improvement Communities.



Blogosphere is a social network

By courtesy of Matthew Hurst

New technologies enable more effective distributed collaboration with promising potential for shared risk and benefits.

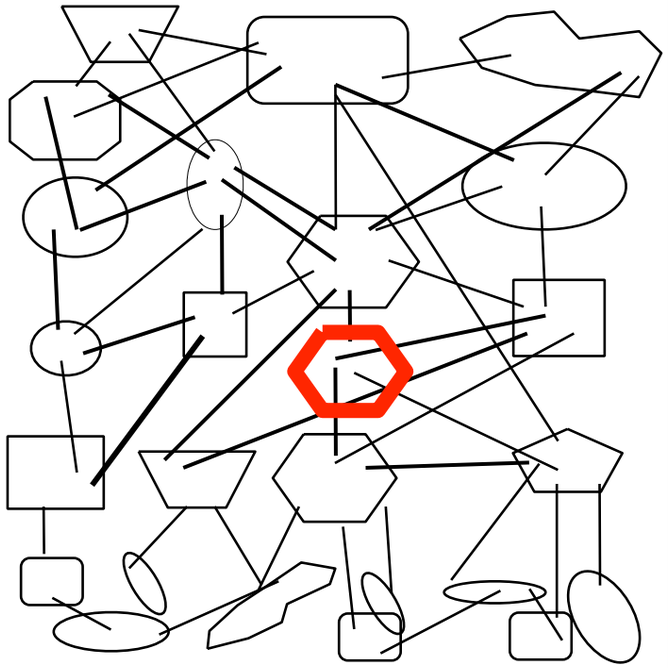
Networked Improvement Communities: NIC's

Humans' Capabilities Depend Upon Their Augmentation Systems

Human System

- Paradigms
- Organization
- Procedures
- Customs
- Methods
- Language
- Attitudes

Capability Infrastructure



Tool System

- Shoes
- Automobiles
- Traffic Lights
- Elevators
- Office Bldgs.
- Word Proccsrs
- Eye glasses
- Hypertext

Skills
Knowledge
Training

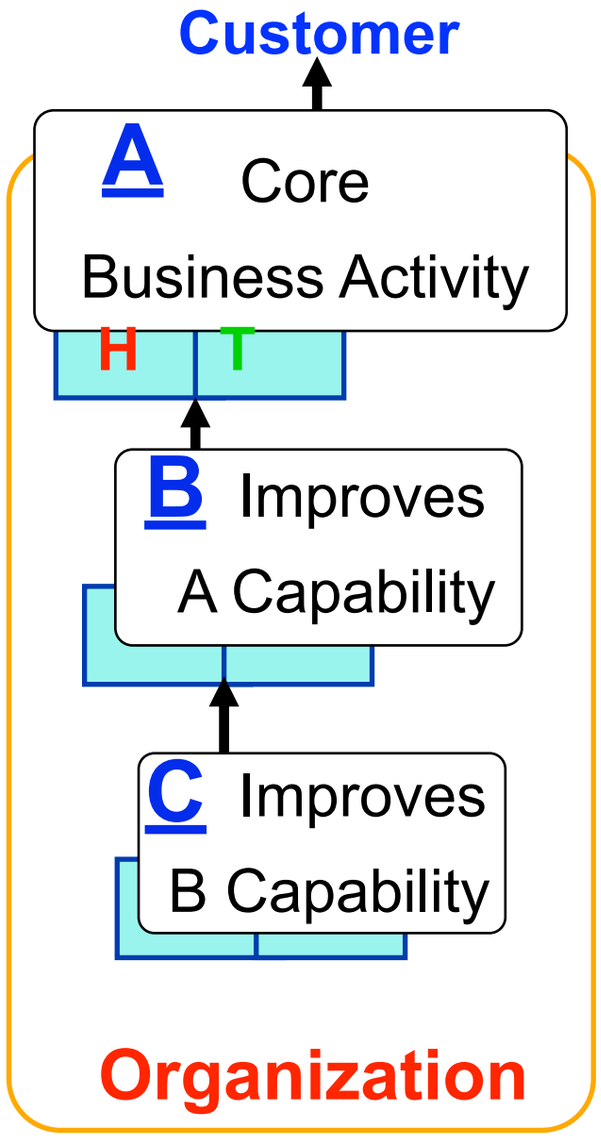
Basic Human Capabilities

Sensory **Perceptual**
Motor **Mental**

This interface is much more significant than "HCI"

Meta approach to Improvement

Agency, NGO, Corporation, Prof. Society, …

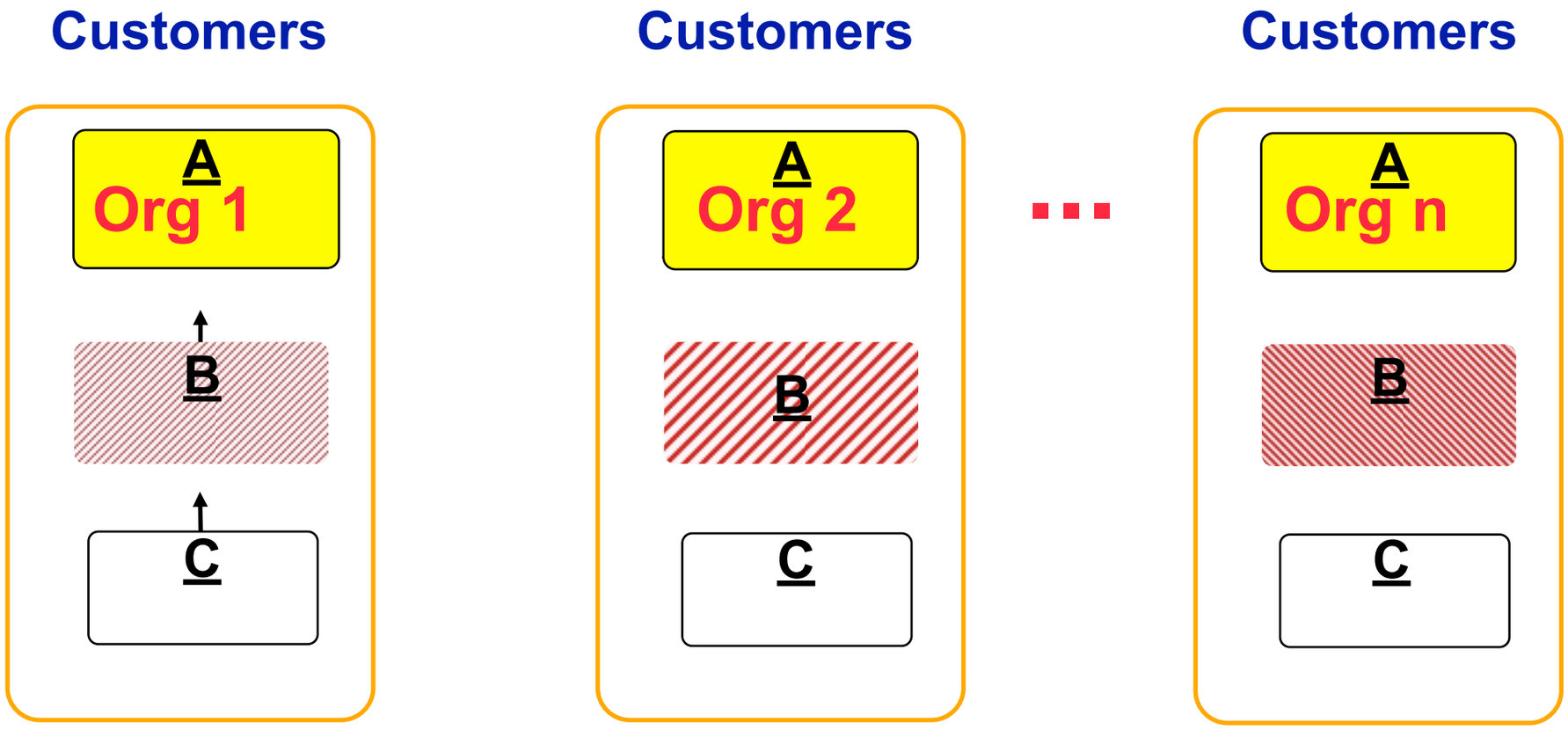


A Activity - serves the customer

B Activity - improves *product cycle* time and quality

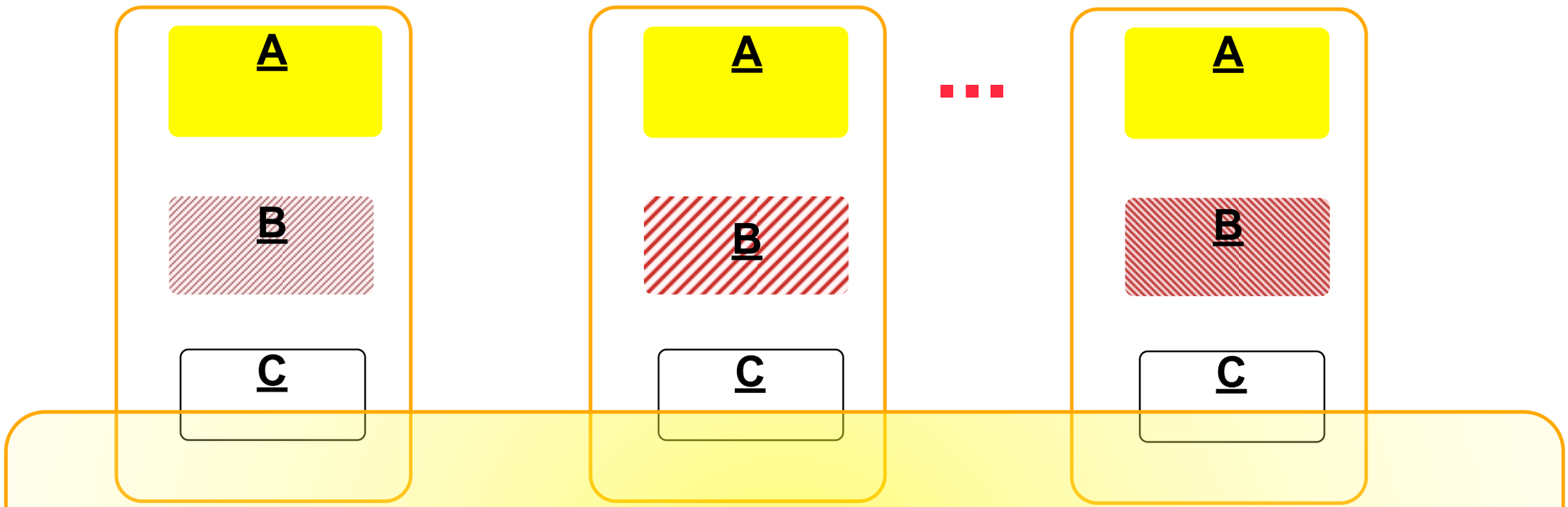
C Activity - improves *improvement cycle* time and quality

Identify Common-Interest Organizations



Multiple organizations pool "C-level" expenses to work collectively on common-capability improvements (Consortia; Prof. Societies).

A New Community focused on Improving "C" Activities across organizations

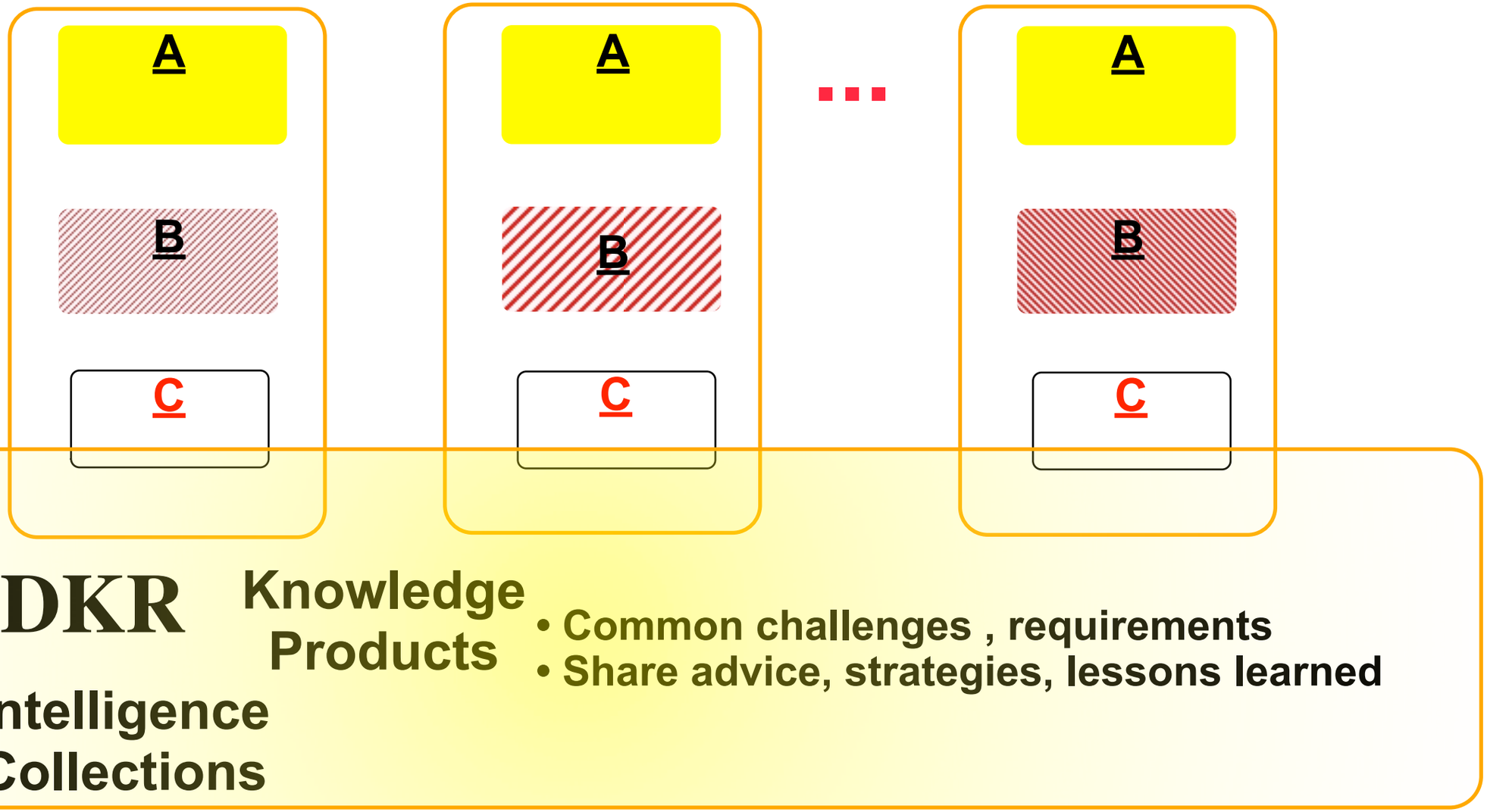


- Common challenges, issues, requirements
- Share advice, strategies, lessons learned
- Common types of "Customers" -- their "Bs."

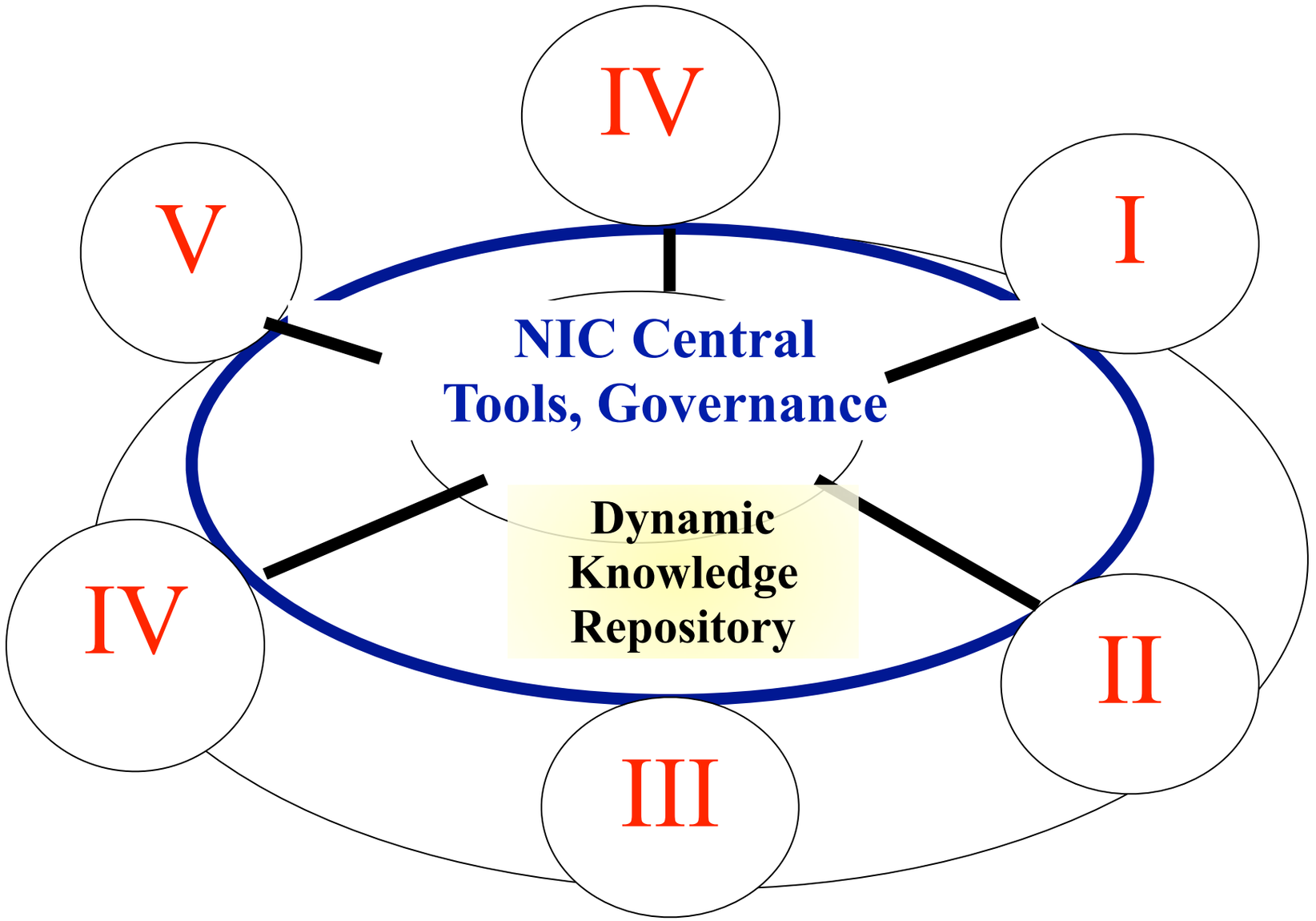
Networked Improvement Community (NIC)

What makes a NIC out of an IC?

- **Actively sharing a Dynamic Knowledge Repository or DKR**
- **A DKR provides the best possible understanding of the ways and means for improving the Improvement capability.**



Networked Improvement Community
Of NIC's – Sharing Risk, Pooling Ideas



- **Investigate & collect intelligence**
- **Provide collaborative website**
- **Rich test bed for experimentation, pilots**

Dynamic Knowledge Repositories

The DKR is the integrated knowledge domain providing the current state of the frontier for that domain via dynamic integration of any new data observations, questions, proposals, and challenges that reflect the current state of the frontier.

An appropriately skilled user must be able to follow the reasoning and verifiable data that lead to understanding the updated domain

Discernible argument structure with linked citations to the specific passages that are components of the structure

Helps to determine whether or not to accept the assertion made

DKR updates might change the direction, future thinking, decisions, etc. for a project

How well does DKR "machinery" support the need to learn about given sub-domains and answer questions

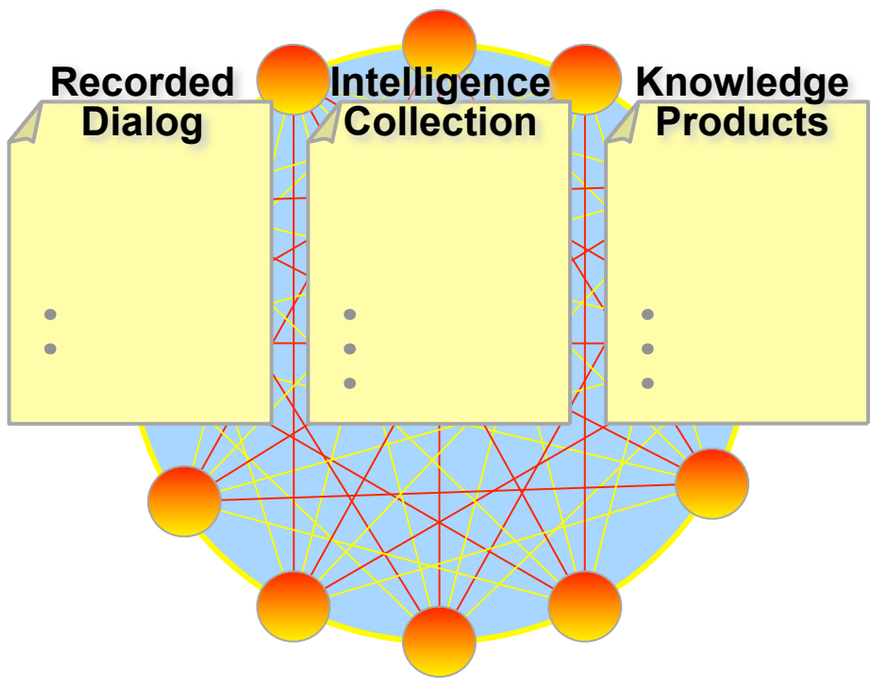
For more on NIC's and DKR's see Appendix slides 34-37

CoDIAK
Concurrent Development Integration & Application of Knowledge

The solution is to give high priority to the collective capability for a distributed community to develop, integrate, and apply new knowledge.

We already had this capability, of course; organizations handle new collective problems all the time.

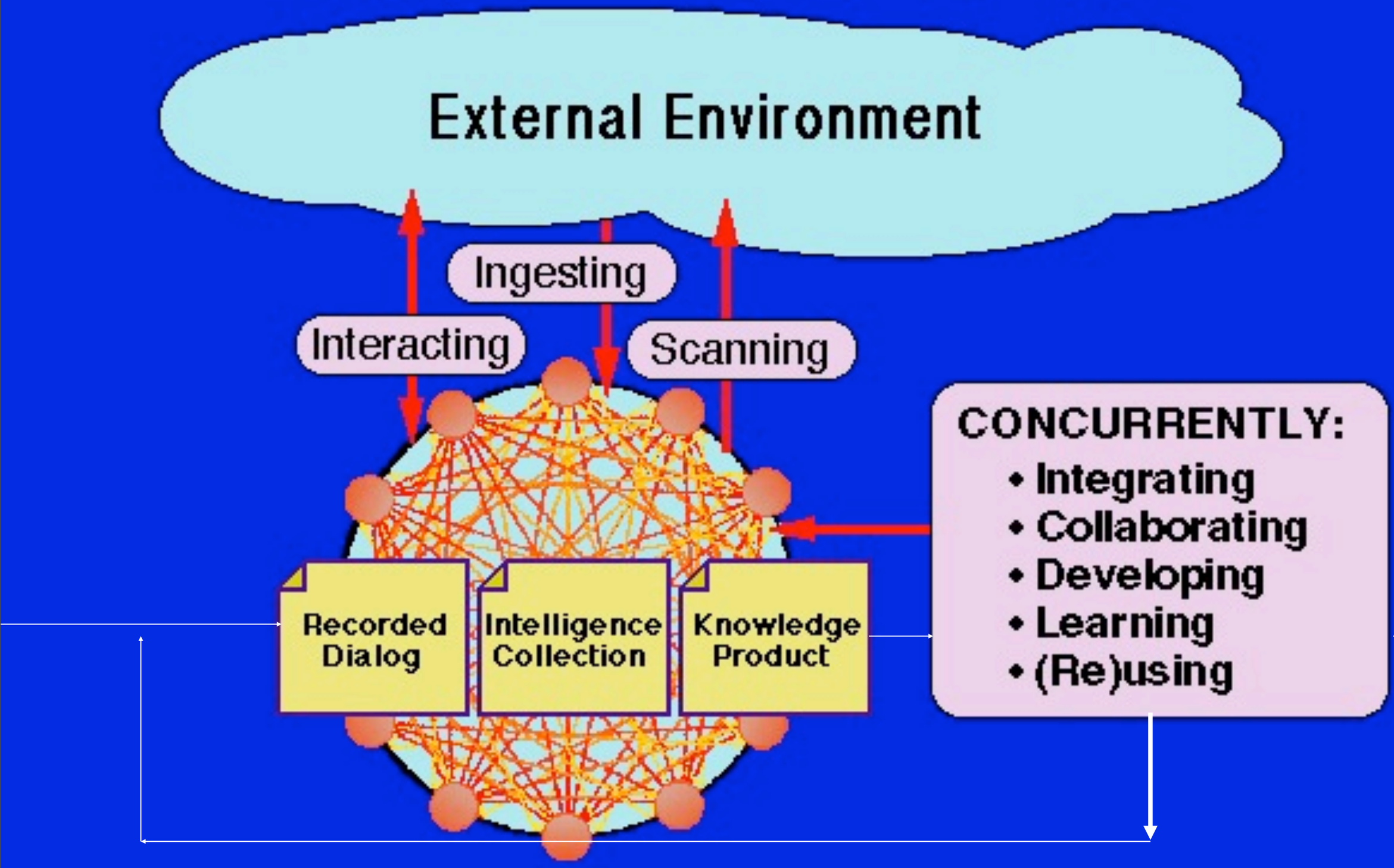
We could be a lot more effective at it.



In this dream, the collaborative capability is called CoDIAK:

Concurrent Development, Integration, and Application of **Knowledge.**

CoDIAK

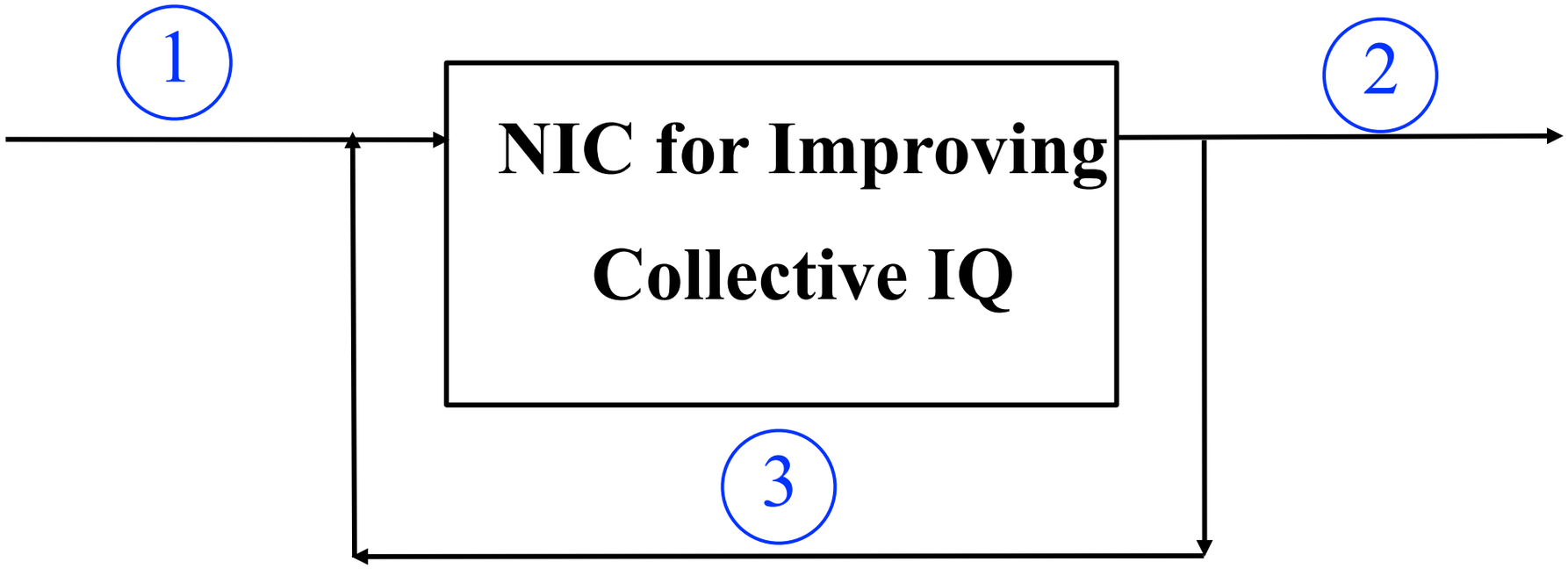

External Environment
Ingesting
Interacting
Scanning
Recorded Dialog
Intelligence Collection
Knowledge Product
CONCURRENTLY:
• Integrating
• Collaborating
• Developing
• Learning
• (Re)using

Bootstrapping

The better we get at getting better, the better and faster we'll get better

And just think of the important role for technologists.

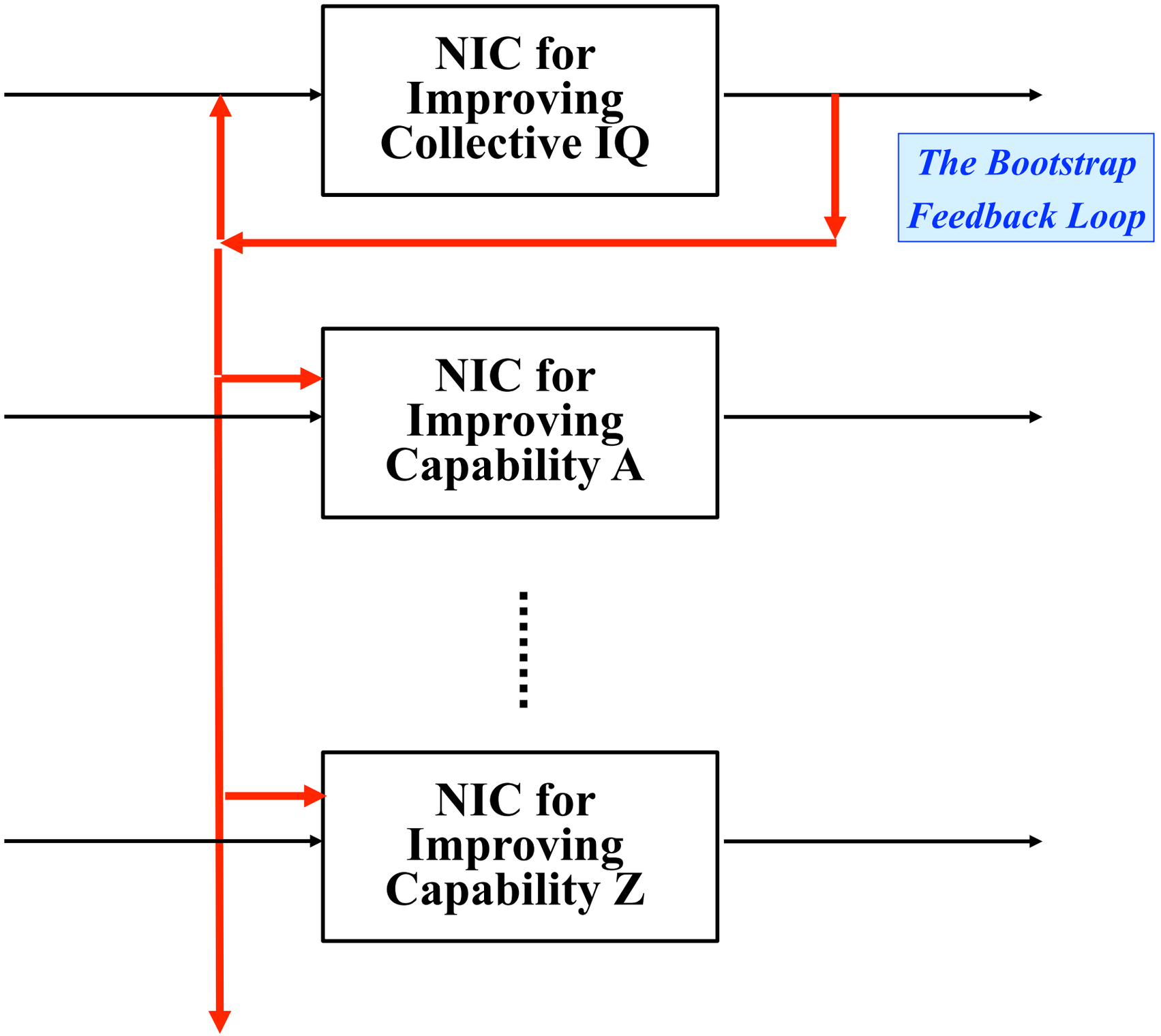
How to Bootstrap Collective IQ



The Bootstrap Feedback Loop

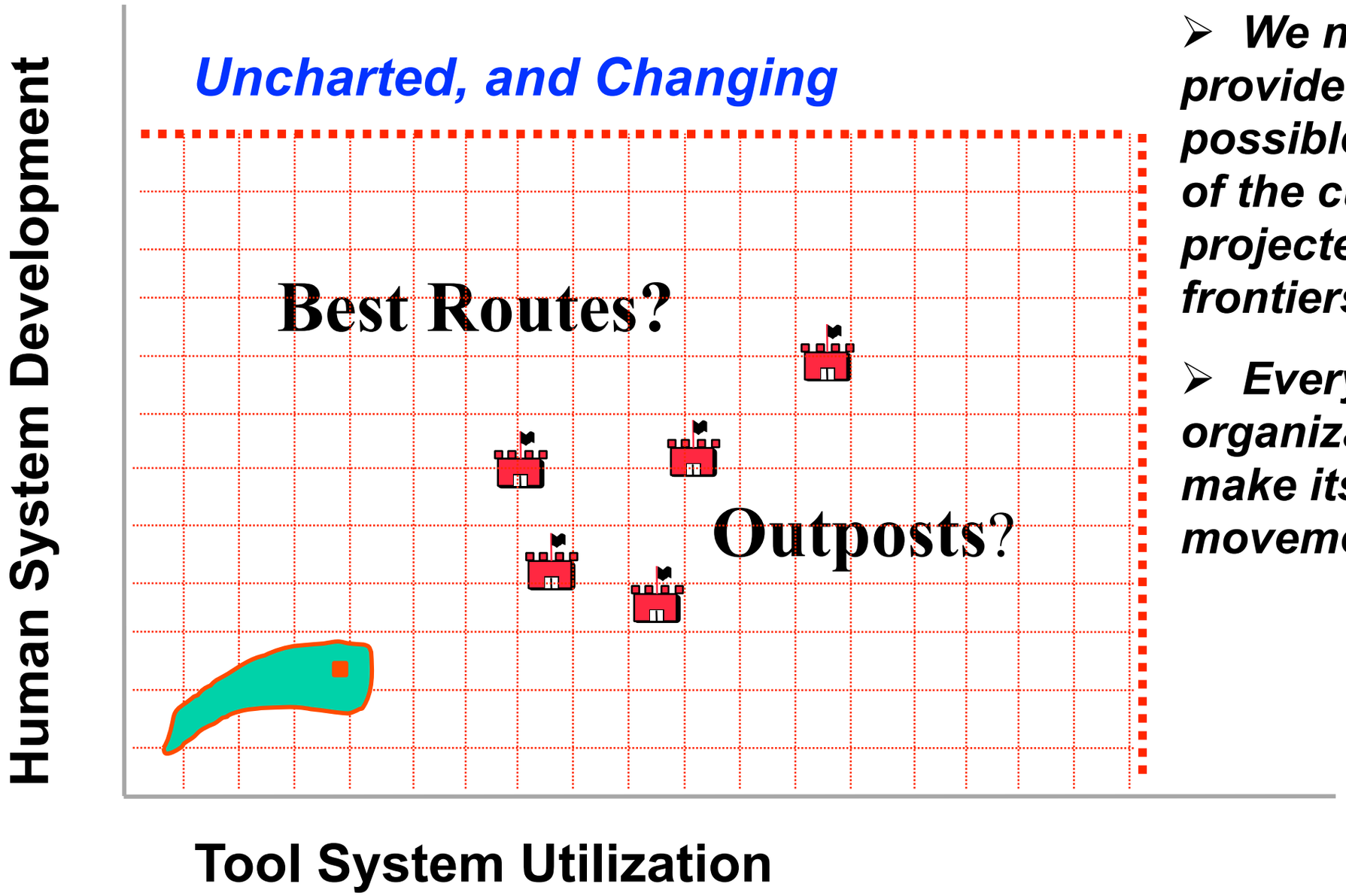
1. **Currently available information about Collective IQ**
2. **Best DKR/knowledge about improving Collective IQ**
3. **NIC immediately utilizing the best Collective IQ improvement knowledge**

Bootstrapping: Extension to Many NICs



Human and Tool System Frontier

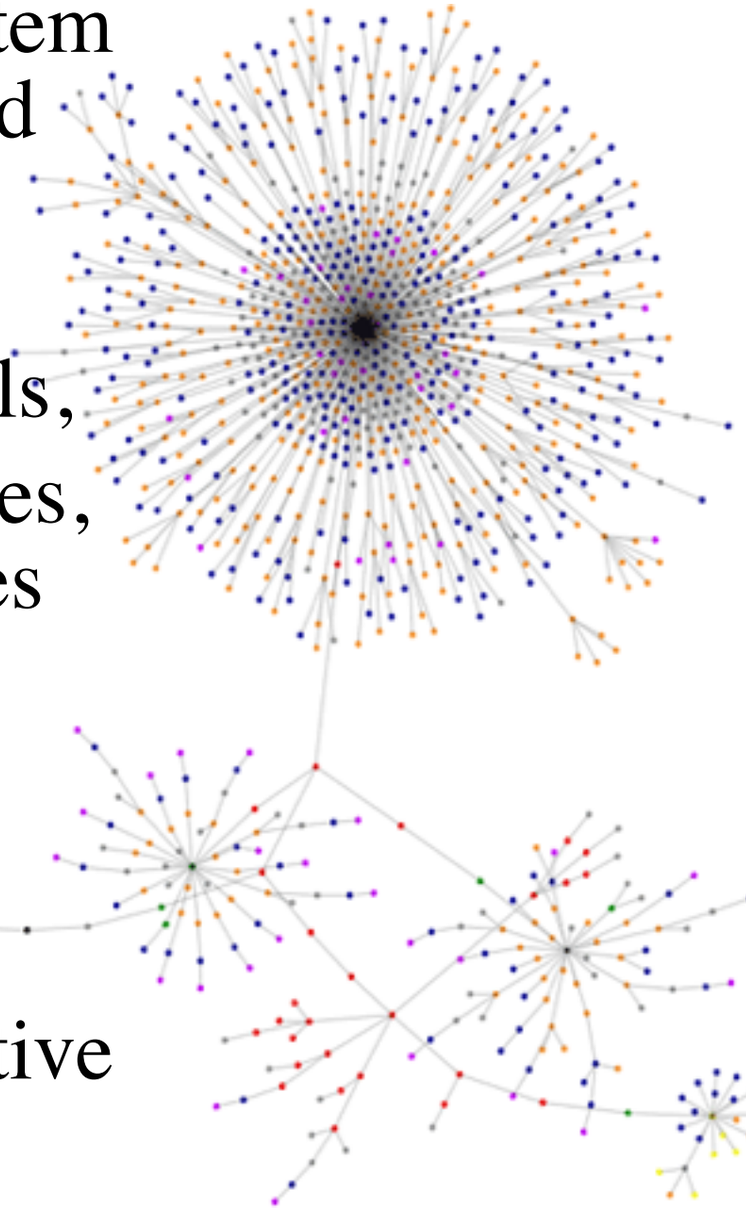
Where should your organization head?
….By what route? Who else is out there?



- ***We need DKRs that provide the best possible understanding of the current and projected states of these frontiers.***
- ***Every evolving organization can then make its own choice of movement in the frontier***

Co-Evolution of Human and Tool Systems

Emphasis on Technology has left Human-System innovation in the dust - seriously neglected and ripe for opportunity



Opportunities abound for developing new skills, collaborative methods, organizational structures, knowledge-worker teams, distributed processes for goal setting, planning and management

Tool options for **view control**, **types and methods of linking** and **high-resolution addressing** could open up many more productive pathways for Human-Systems

Open Hyperdocument

We must shed our outdated concept of a "document" and examine what we want

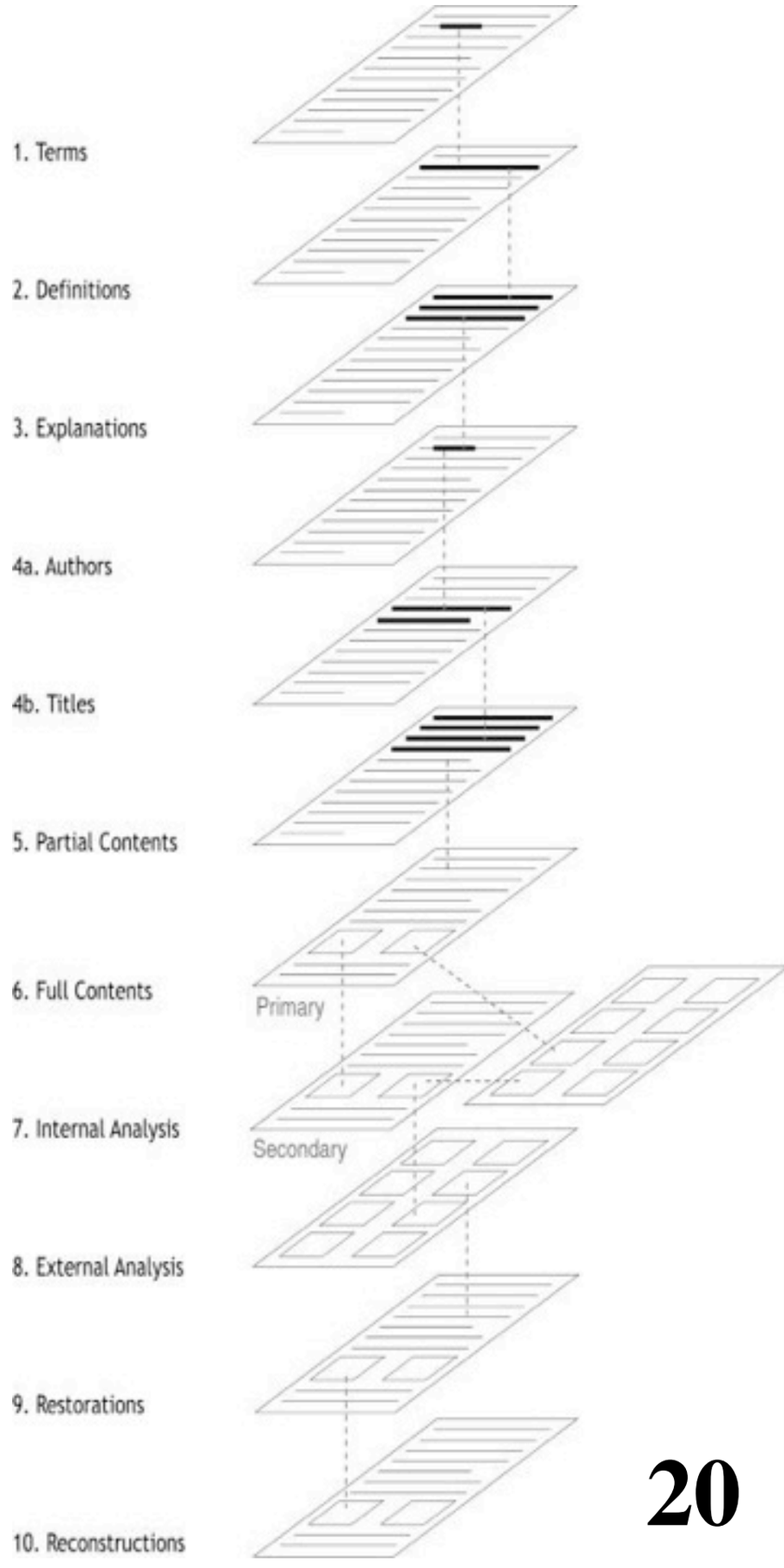
We need to think in terms of flexible jumping and viewing options.

The objects assembled into a document should be dealt with explicitly as

-representations of kernel concepts in the authors' minds,

-explicit structuring options have to be utilized to provide a much enhanced mapping of the source concept structures.

www.isoc.org/inet2000/cdproceedings/6d/6d_1.htm



The Open Hyperdocument System

Open Hyperdocument System (OHS)

Supports the implementation and use of DKRs & the way we want to work

"Open" - Scaleable, evolvable, interoperable across domains

"Hyper" - To enhance access, maneuverability, and (re)utilization

"Document" - To capture, integrate, and manage the emerging heterogeneous knowledge

"System" - Provides a complete "knowledge workshop"

Key Launching Step in Creating a NIC's "Knowledge Workshop"

- Co-evolve from NIC's own starting point (legacy technologies, systems, cultures)
- Provide a direct useful entry step for the first stage of the human/tool co-evolution

Bootstrap Project - OHS

– Develop framework for hyperdocument architecture

– Develop framework for the functional tool systems

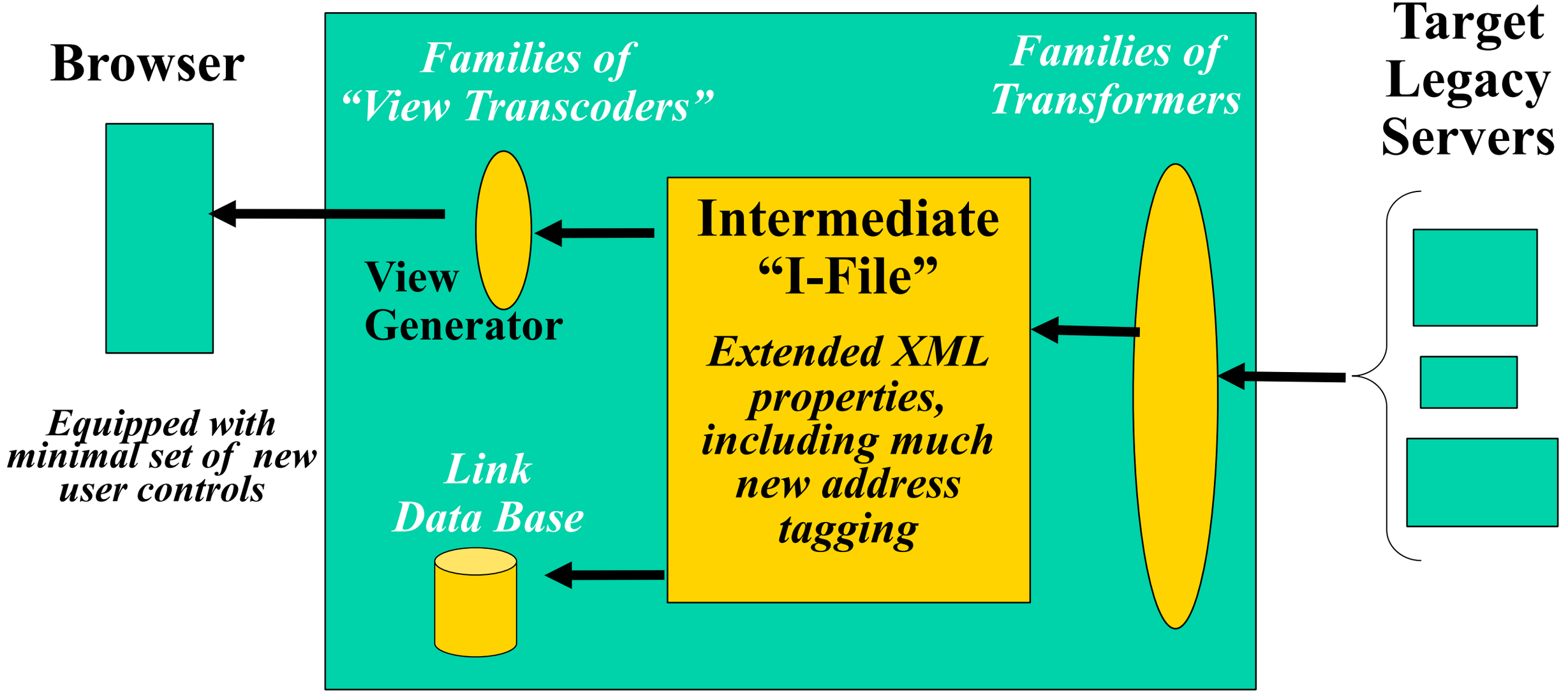
HyperScope is the smoothest first step, providing the least disruptive, best evolutionary potential

Stage 1: OHS-HyperScope Browsing

Over a wide variety of legacy files

- High-resolution linking

- Many viewing options



And also, hi-resolution linking to audio, video …

“Optional views” in “Hypertext”

…..in the sense that Vannevar Bush’s Memex enabled ”jumping” to other photo-captured frames ….

Suppose we provide for our computer to re-shape, re-color, re-arrange, etc., our stored information …

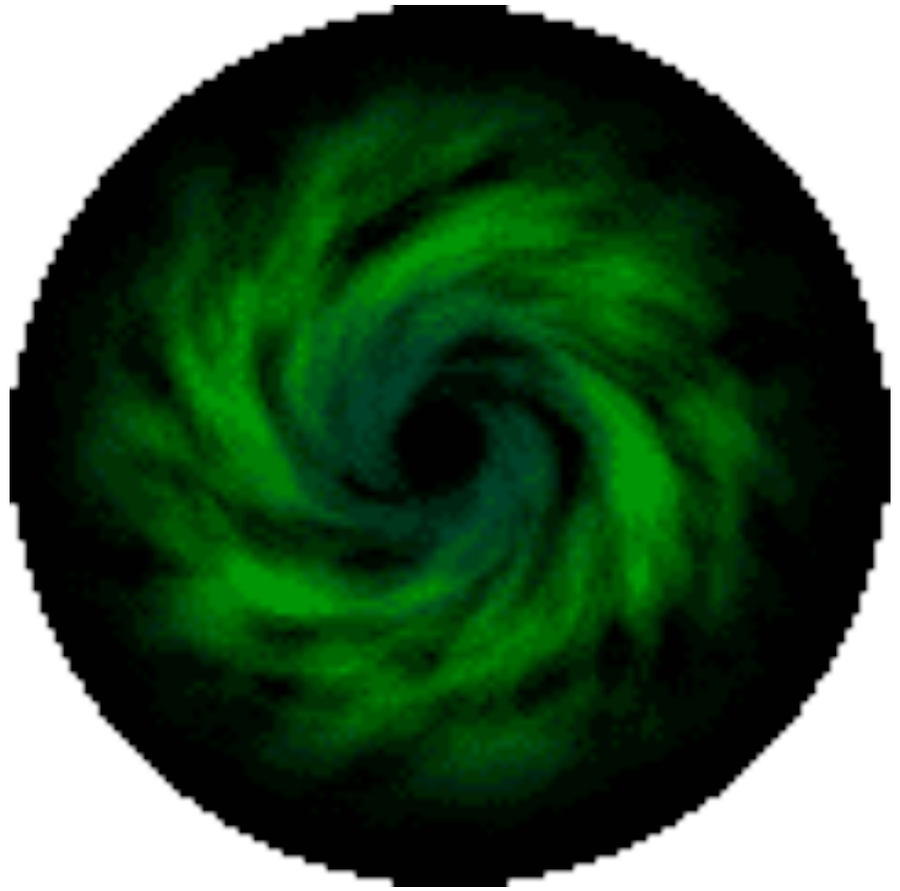
… on the fly, with quick option-actions,

… portraying content in ways that help the human’s perceptual machinery better grasp the concepts and their relationships.

See examples in Appendix Slides 38 -52

The "Link Data Base"

- Can directly support full-scale **"Argument Structuring"** and its graphic portrayal.
- Including **"Issue-based Information Systems"** (IBIS), tracking the evolution/resolution of issue-oriented dialog
- Records by which back-tracking can determine:
  - "Attribution" for helpful ideas or assessments
  - Isolate bad ideas or problem assessments that steered an issue off target.
- Support more carefully * **scrutinized** * analysis and judgements



What is in the Link Database ?

For every HyperScope link that was actuated into a given I-File, the Link Database will record:

- the target object
- the high-resolution location of the link in its “home file”
- the “link-type designation” embedded in the link syntax (whose significant usage will be part of the new working conventions of HyperScope users)
- for some link types, also: optionally viewed “content” -- e.g. comments about the targeted object, or highlighting of objects on the targeted document, or even one or more useable links which the reader can exercise

Evolve towards a Full-Scale Open Hyperdocument System

Start with the HyperScope

Extend viewing and linking options

Add optional User Interface systems – pursuing range from “Pedestrian Users” to highly trained, top-capability “Expert Users.”

Steady extension of functional utility and corresponding file properties

Aim toward most effective development and maintenance of DKRs, for an increasing array of important knowledge domains.

The Web/HTML publishing-browsing landslide has moved steadily toward a highly structured, object-oriented architecture with integrated editor-browser tool sets.

This is NOT the way the majority of people do all their work.

Neats vs Scruffies

Draft notes, E-mail, plans, source code, to-do lists, what have you- all can be hyperdocument pieces

Instantly and intrinsically linkable, and with work processes involving fewer and fewer hard-copy printouts.

It has been exciting to watch the emergence of the World Wide Web

But it pains me that we haven't yet put up an explicit CoDIAK target, nor explored how NICs

Since the first of these dreams got fixed in my head, decades ago, I'm struck with the realization that **the sooner the world gets serious about pursuing the possibilities**, the greater the chance that we will have to steer the vehicle we are in, to places that better for humankind

Wright brothers." Online Photograph. Encyclopædia Britannica Online. 21 Aug. 2007 http://www.britannica.com/eb/art-15550

If the dream of improving human destiny isn't enough, how about the thought that the companies that adopt the best CoDIAK-improvement strategy will have a significant competitive advantage.

Wouldn't you want your group to have the highest collective IQ?

Someone once called me "just a dreamer."

That offended me, the "just" part;

being a real dreamer is hard work.

It really gets hard when you start believing in your dreams.

Appendix

Selected Reference Links

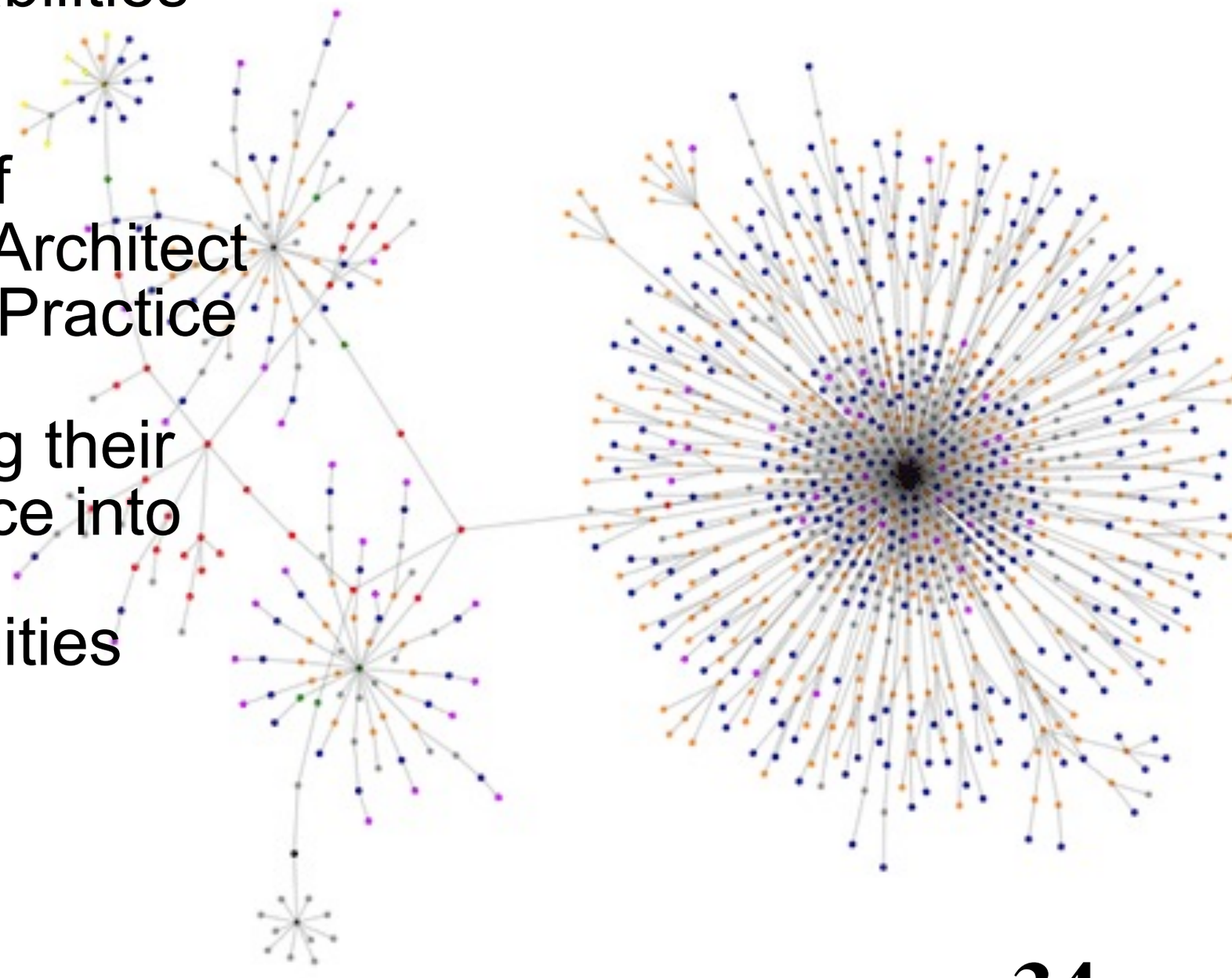
- Subset of Engelbart papers that are on the Web: http://www.bootstrap.org/institute/bibliography.html
- – Special interest in Items below:
- #3: Augmenting Human Intellect: A Conceptual Framework. Douglas C. Engelbart. 1962.
- #29: Toward High-Performance Organizations: A Strategic Role for Groupware. Douglas C. Engelbart. 1992.
- #32: A Draft OHS-Project Plan (The HyperScope) Douglas C. Engelbart. 2000

Cultivate Special Knowledge-Work Capability-Development Roles

1. Start building KW capabilities using the HyperScope

2. Actively develop role of Knowledge Workshop Architect within Communities of Practice

3. Emphasize their turning their Communities-of-Practice into NICs -- Networked Improvement Communities using DKR's



Getting Started

- *Study organizations whose challenges are to improve their capability to cope with complex challenges*
- How have they organized the knowledge they need to understand best those challenges?
- Look for examples of candidate DKRs associated with those domains.
  - Body of knowledge associated with domain, e.g. “handbook” or “encyclopedic” concept
  - Provides the means for skilled participants to use knowledge domain
  - Integrated knowledge, not just a list of sources

Key, Central Activity:
Learning how to build better DKRs

So why not get a bunch of different university groups building prototype DKRs for selected knowledge domains?

In different departments – domains relevant to their study areas …

In different universities – OK (preferable) to focus on same domains as other universities.

Each university has one special domain: A DKR about DKR development -- to facilitate the learning process about how better to develop and learn from DKRs.

Challenges for DKR Development & Use: Rationale for Building a DKR of DKR's

- Special sets of skills required for increased capabilities
  - Who will provide the integration & linking of disparate information into the solid, verifiable DKR structures
- Properties & structural principles for DKR knowledge containers will be critical part of DKR evolution
- Dynamic, seamless integration of new data while preserving the DKR's evolutionary history
- Assessment and rating of the organization's capabilities to develop and use its DKRs
- Capability Infrastructure – support a wide range of usage capabilities, e.g. multiple user interfaces that reflect increasing levels of user expertise

Example: "EXPERT-User" AUGMENT Command Verbs for the BASE subsystem (Text & File Manipulation)

- *Act Append Break *Check *Clear *COMment *CONnect Copy *Create Delete *DETACH *ENlarge EXECUTE *EXPunge Force *FReeze Goto Help Insert Jump Logout Move *Point Print *PROcess Quit *REName Replace *RESet *REVerse *SEt *SHow Sort *STArt *STOp *THaw Transpose *TRIm *TYpe *UNdelete Update

- NOTE: Type the Cap-noted letters (start with SPACE for the "*" terms) and the system will recognize the abbreviation and pop up the full-term command line.

Example: "EXPERT-User" AUGMENT Command Nouns for the BASE subsystem (Text & File Manipulation)

- Nouns: Branch Character *DIRective Directory File Group Invisible Link Number *Phrase Plex Statement Text Visible Word

- Type Chars:
  dw
  mb
  jl

Command Line:
Delete Word
Move Branch
Jump Link

Powerful “Macro Commands” significantly extend the power of the AUGMENT user.

- Setting them up becomes quite simple – writing them utilizing the same “Command Language” and the same highly flexible and explicit addressing.

- E.g., evoke this one with four-char call, give it the initials for friend Joe, and it compiles the content filter which will show me all of Joe’s email that I’ve stored in a given file domain.

High-resolution addressability – Basic NLS feature from mid-60s

- Initial purpose, so that one could use a link to cite ANY OBJECT in ANY FILE.
- Then an increasingly flexible and powerful addressing scheme evolved.
- “Open Jumps” began to be supported – e.g., a user can type Jump Item ph,JS.I which leads to his phone-directory file, then to the node labeled “JS” (for Jim Smith) where there is a simple link leading to the Jim Smith entry.

Lower-Case-Letter Viewspecs

a: show one level less
b: show one level more
c: show all levels
d: show first level only
e: show levels down to reference stat…
f: recreate window if necessary
g: show branch only
h: show all branches
i: filter statements
j: don't filter statements
k: show next filtered statement
l: show plex only
m: show statement numbers/SIDs

Upper-Case-Letter Viewspecs

A: show level indenting
B: don't show level indenting
C: show statement names
D: don't show statement names
E: paginate when printing
F: no paging; recreate display (display)
G: statement numbers/SIDs right
H: statement numbers/SIDs left
I: show SIDs, not statement numbers
J: show statement numbers, not SIDs
K: show statement signatures
L: don't show statement signatures
O: user sequence generator on
P: user sequence generator off

Some things we learned from twenty-five years', active-use evolution of the NLS-AUGMENT System

Prime objective was "Capability," with a UIS that provided effective evolutionary learning for what steadily extended as a natural-language vocabulary.

Enter a minimum string of characters for each the verb and then the noun – and the system recognizes the intent and automatically fills out the whole-word command expression. So the user knows she has established a well-formed command.

Comparative use of Pub #32

- … From this Pubs listing: http://www.bootstrap.org/institute/bibliography.html
- … Let's use the following publication for a brief demo of what HyperScope would do:
- #32: A Draft OHS-Project Plan, Douglas C. Engelbart, 2000: http://www.bootstrap.org/augdocs/bi-2120.html

Sample Views: The HyperScope File <http://www.bootstrap.org/augdocs/bi2120.html>

INTRODUCTION

Large-scale challenges are best served if there are appropriately scaled strategic principles to guide their pursuit. And special value results if the launch plan of a long-term and large-scale strategy produces significant payoff accrual early in the pursuit.

We are addressing the large-scale, pervasive challenge of improving the collective development and application of knowledge. Many years of focussed experience and conceptual development underly the strategic framework guiding this proposal.

Phase-1, OHS Launch Project: HyperScope

Show just paragraphs' first lines

INTRODUCTION

Large-scale challenges are best served if

We are addressing the large-scale,

Phase-1, OHS Launch Project:

Special Note: Implementation of the

The HyperScope will be a lightly modified

A Hyperscope user will be able to follow

Brief Functional Description of Phase-1

Now don’t show blanks between lines

INTRODUCTION
Large-scale challenges are
We are addressing the large-scale,
Phase-1, OHS Launch Project: HyperScope
Special Note: Implementation of the
The HyperScope will be a lightly modified
A Hyperscope user will be able to follow
Brief Functional Description of Phase-1
1. In response to what may be an ordinary
For any community seriously interested
2. High-Resolution Addressability:
E.g., here "http://xxx.xxx.xxx#aaa“
3. View-Specifications: The HyperScope

Show only the first two levels

INTRODUCTION
Large-scale challenges are
We are addressing the large-scale,
Phase-1, OHS Launch Project:
Special Note: Implementation of the
The HyperScope will be a lightly modified
Brief Functional Description of Phase-1 Phase-2:
Maturing/Evolving the
Evolution of the Intermediary File format
An OHS "User Interface System" (UIS)
Provision for archiving, version control,
Now the VERY important feature of this
And the critical community-development
For the scale of utilization that will be

Show one-line, next-level content of "Brief functional description"

Brief Functional Description of Phase-1

1. In response to what may be an
2. High-Resolution Addressability:
3. View-Specifications: The HyperScope
4. Expanded set of HyperScope
5. Copying-Pasting HyperScope Links:
6. Back-Link Management: Provision will
7. Extended addressing conventions to
8. Same file in multiple windows -- no

Now show only the first level

INTRODUCTION
Phase-1, OHS Launch Project:
Phase-2: Maturing/Evolving the
Phase-3: Special Evolutionary Provision:

Show all lines of top-level statements,
with blanks between them.

INTRODUCTION

Phase-1, OHS Launch Project: HyperScope enhancement of Legacy Systems:

Phase-2: Maturing/Evolving the

Phase-3: Special Evolutionary Provision:


Program for the Future
Challenge