

Modeling Lifelong Learning Networks

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paper at: <http://hdl.handle.net/1820/331>

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Content

- Background: Learning Networks RTD Programme
- More in detail:
Model and Simulation of a LN:

“Increasing Learner Retention in a Simulated Learning Network using Indirect Social Interaction”
(draft article)

Background

- Open University of the Netherlands.
- RTD into learning technologies:
Aim: development of new learning technologies to support lifelong learning
- Major outcomes:
 - models and theories
 - specifications of learning technologies
 - prototypes of new technologies

Learning Networks for Lifelong Learning

A learning network is a *group of persons* who *create/perform, share, support and study* learning activities and *units of learning* in a specific knowledge *domain*.

So, a network in the following sense

A group of persons:

- connected to each other in a **social** sense
- connected to each other in a **technical** sense
- connected to relevant **learning resources**
- connected to each other in order to **learn** from & with each other
(also producing new learning resources)
- ✓ as independent as possible of constraints like:
location, institution, job, time, specific technologies
- ✓ persistent over time to support lifelong learning in a certain field

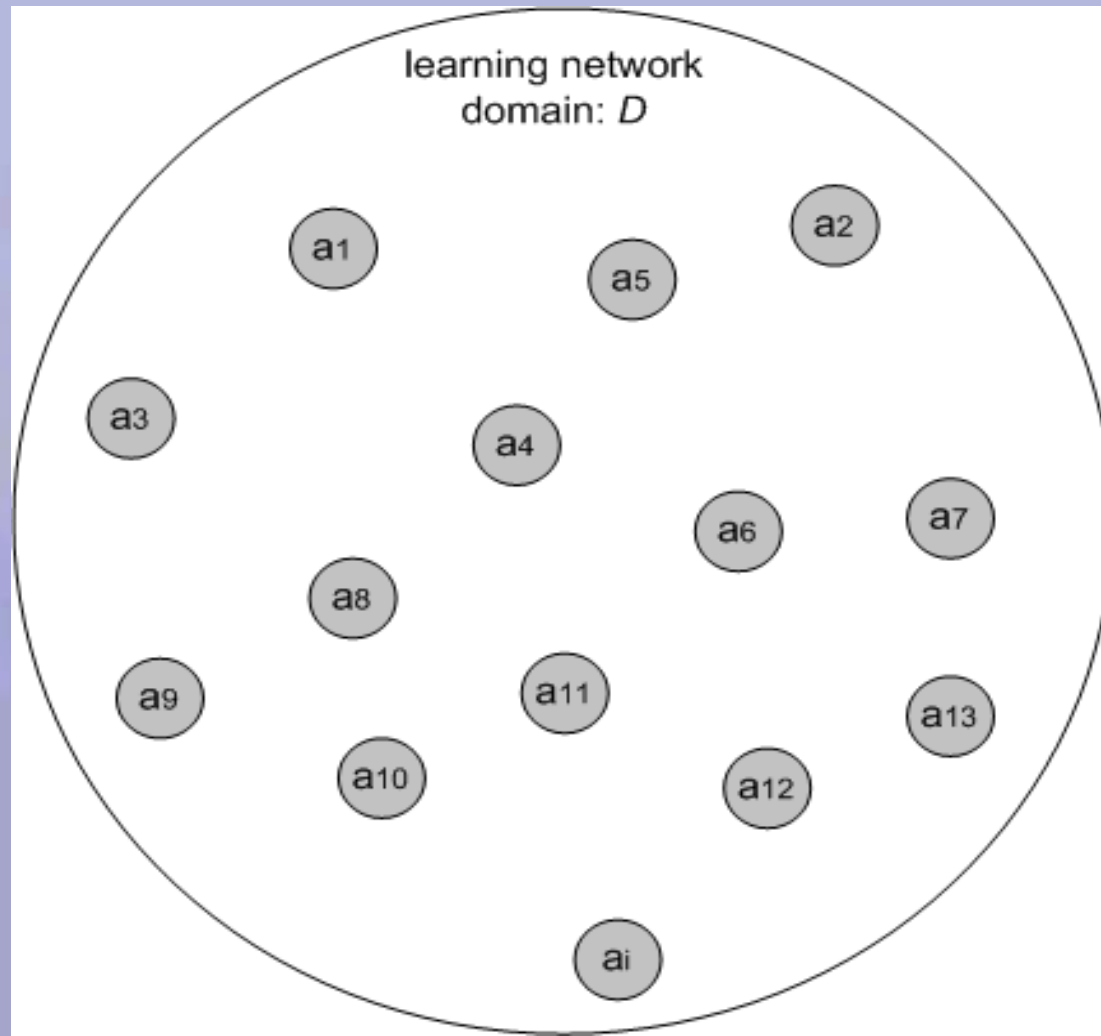
How to realise Learning Networks for Lifelong Learning?

Several views of a Model of a Learning Network

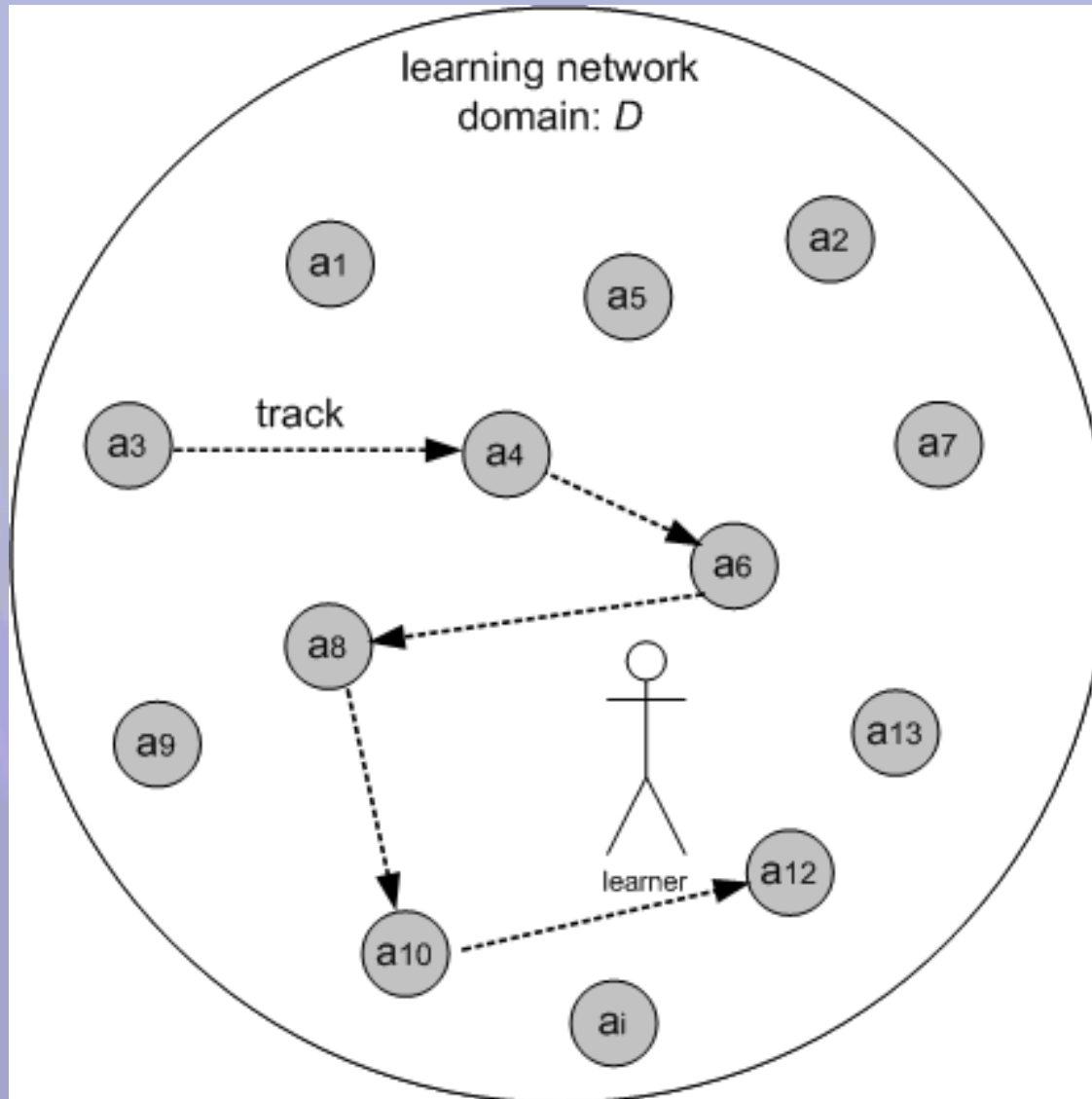
- Learning Network modelled as a Graph
- Use Case Model
- Architectural Model

Graph Representation of a LN

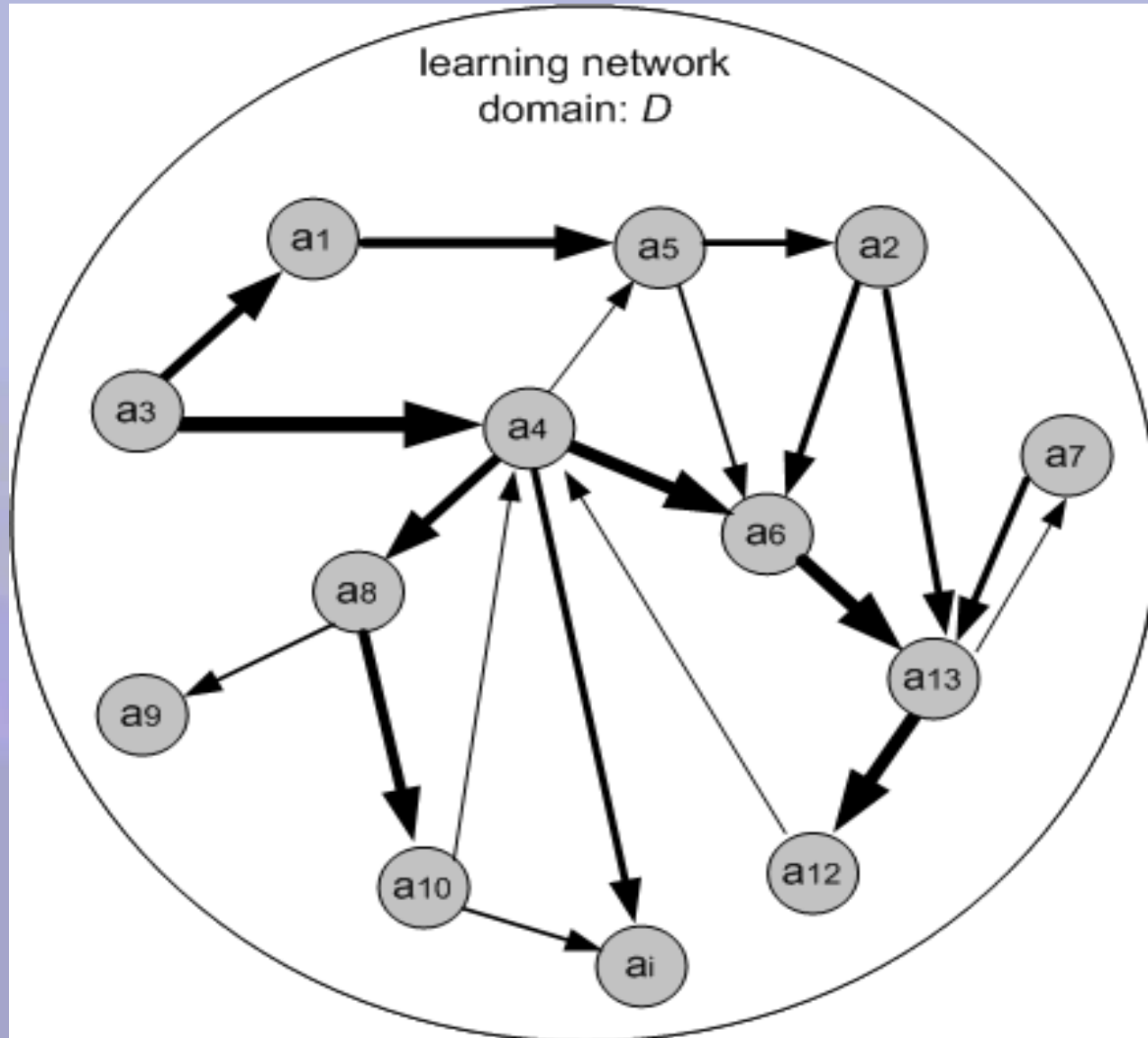
A *learning network* can be represented as a graph of '**activity nodes**' (runs of units of learning) within some knowledge domain



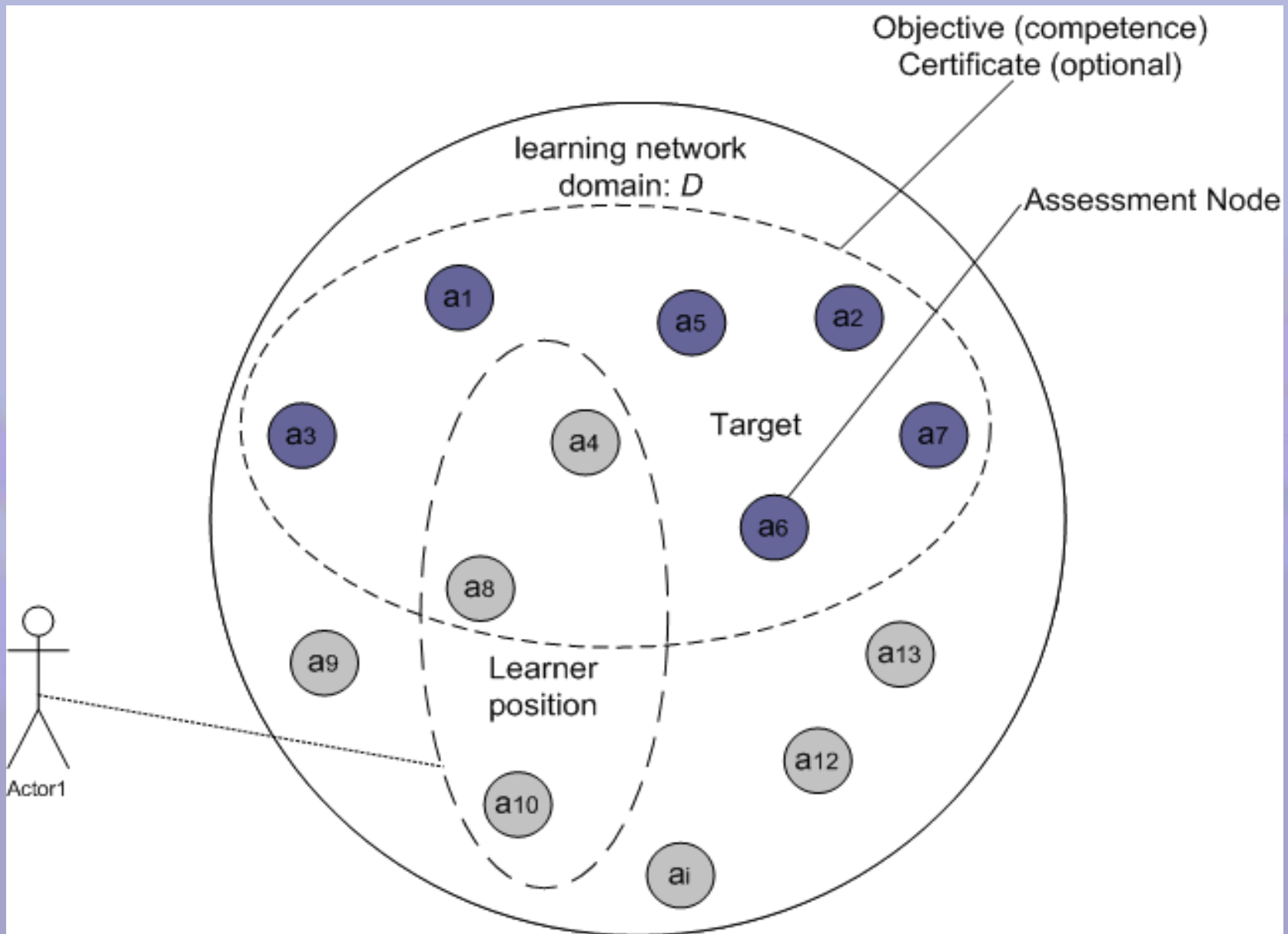
LN Graph with a learner track



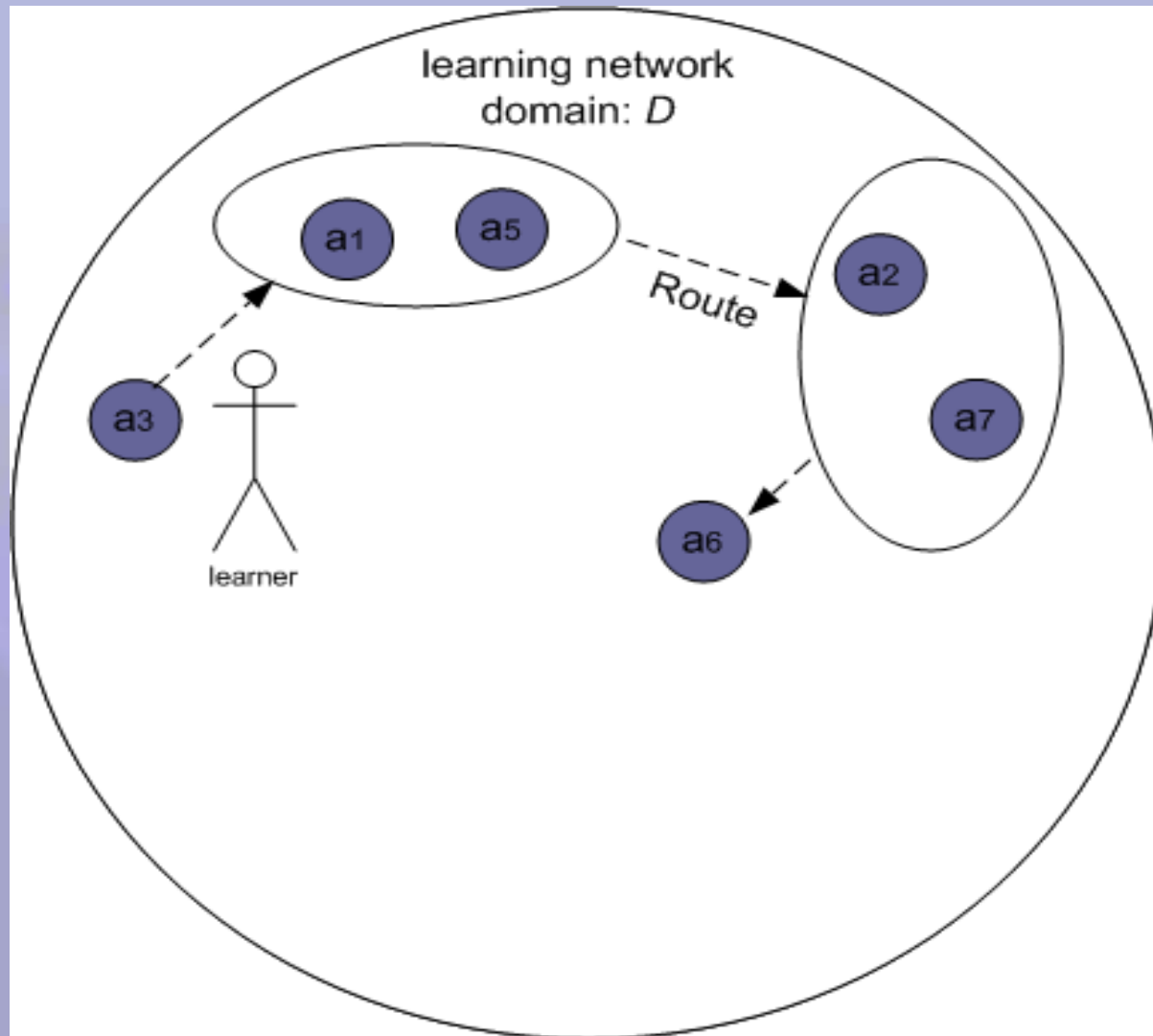
Patterns of Collective Tracks Emerge



Learner Positions and Objectives



Planned Learner Routes ("curriculum")

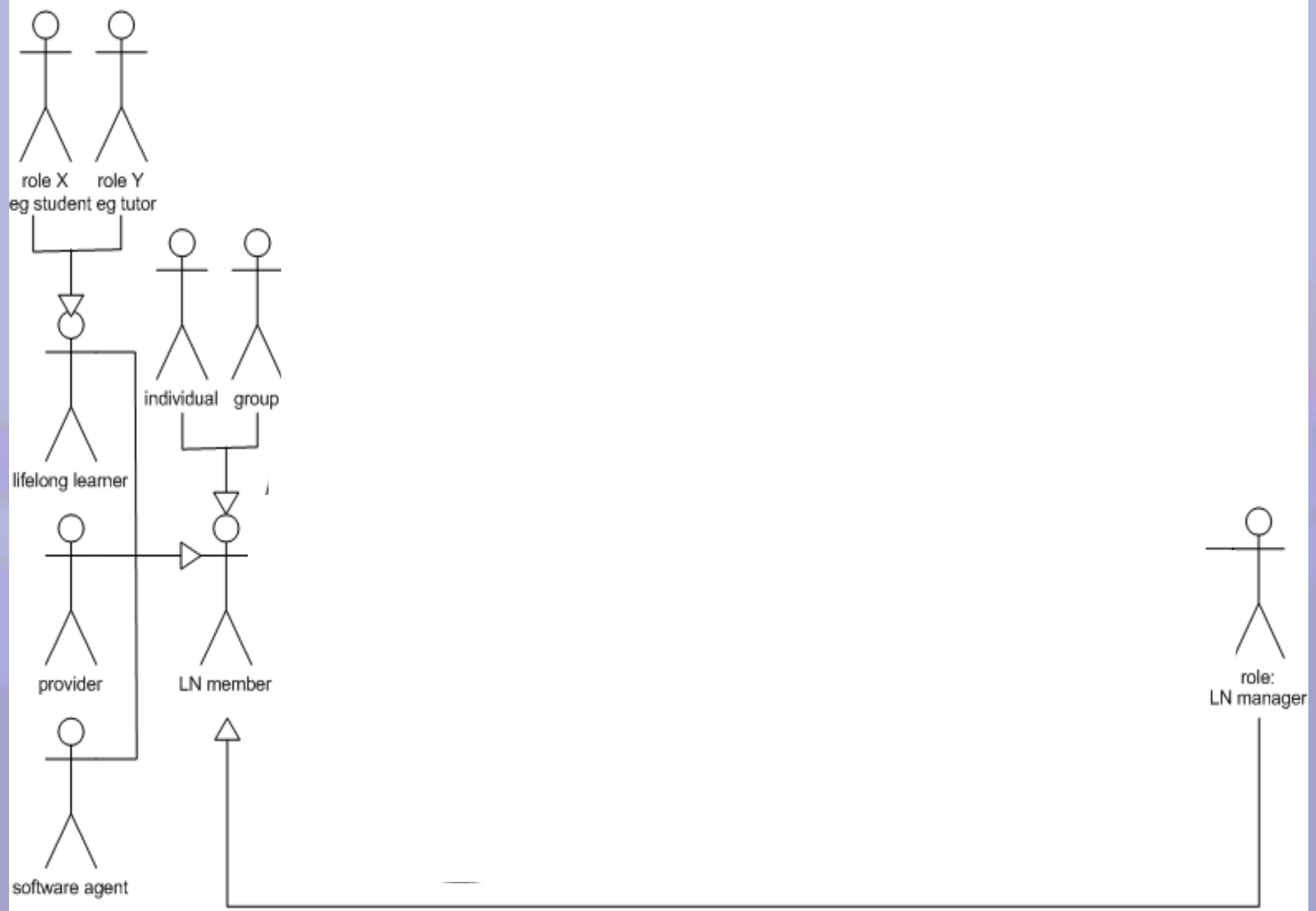


What activities do users perform in
a Learning Network?

=> Use Case Model

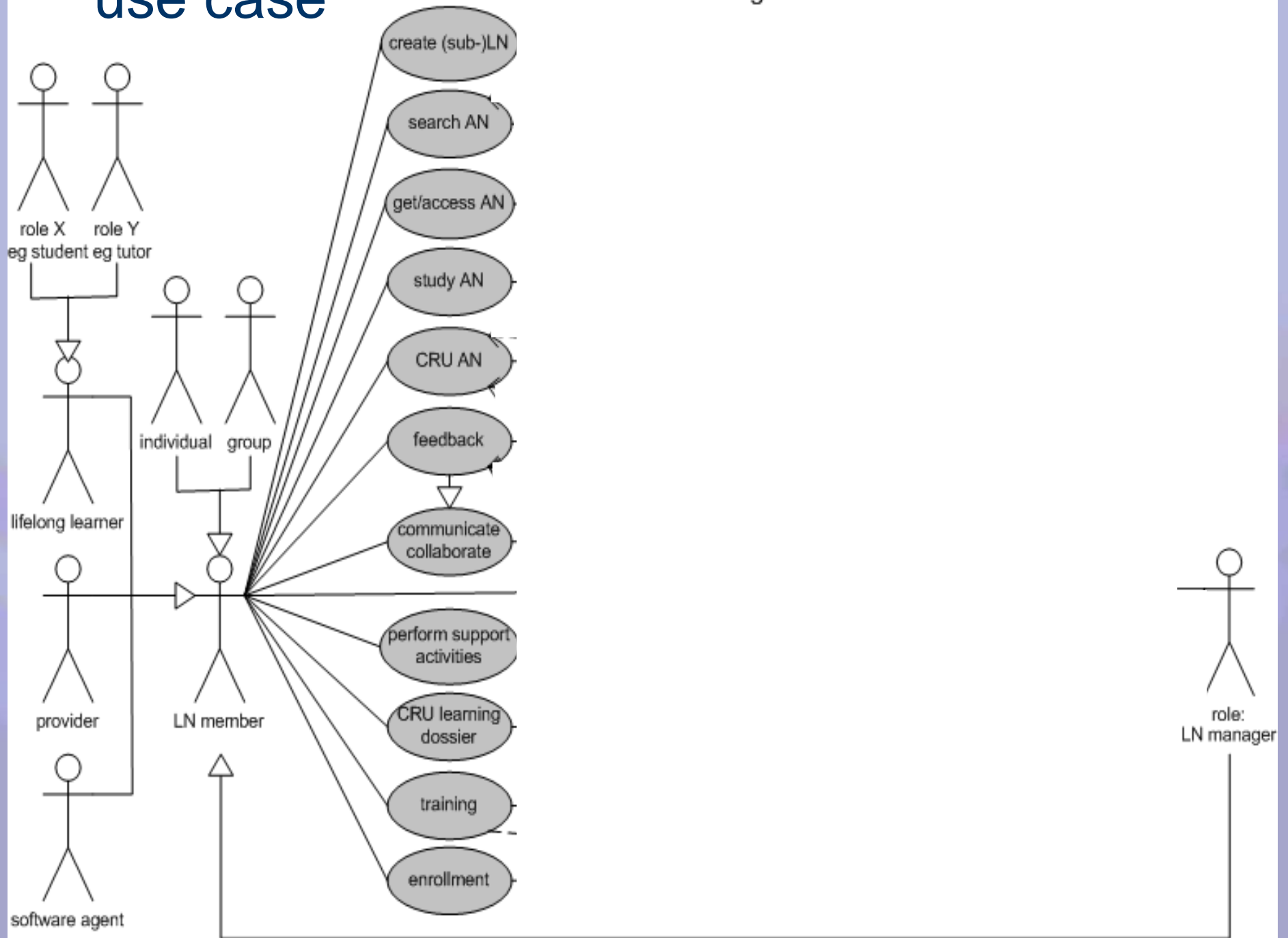
use case

Learning Network

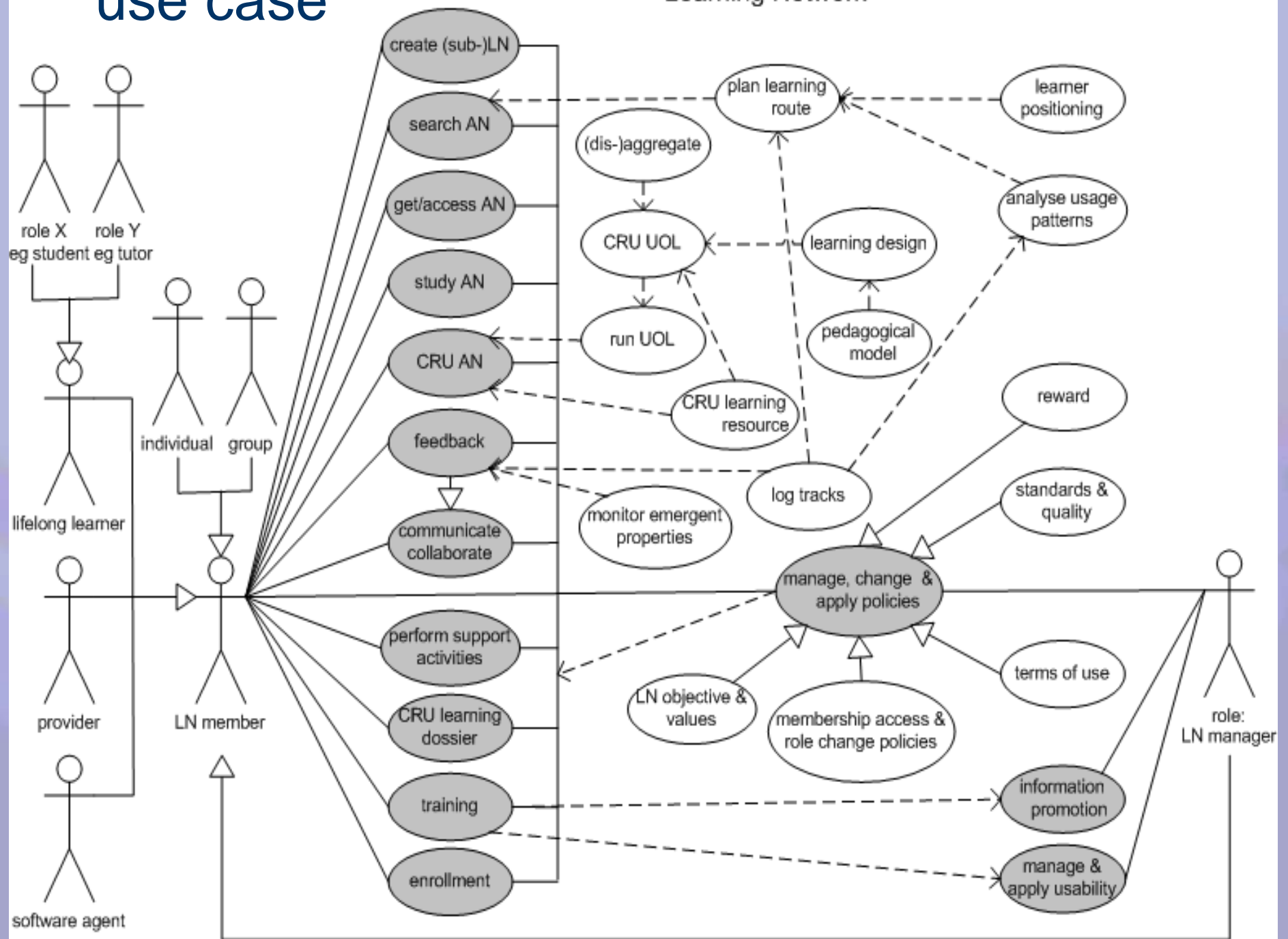


use case

Learning Network



use case

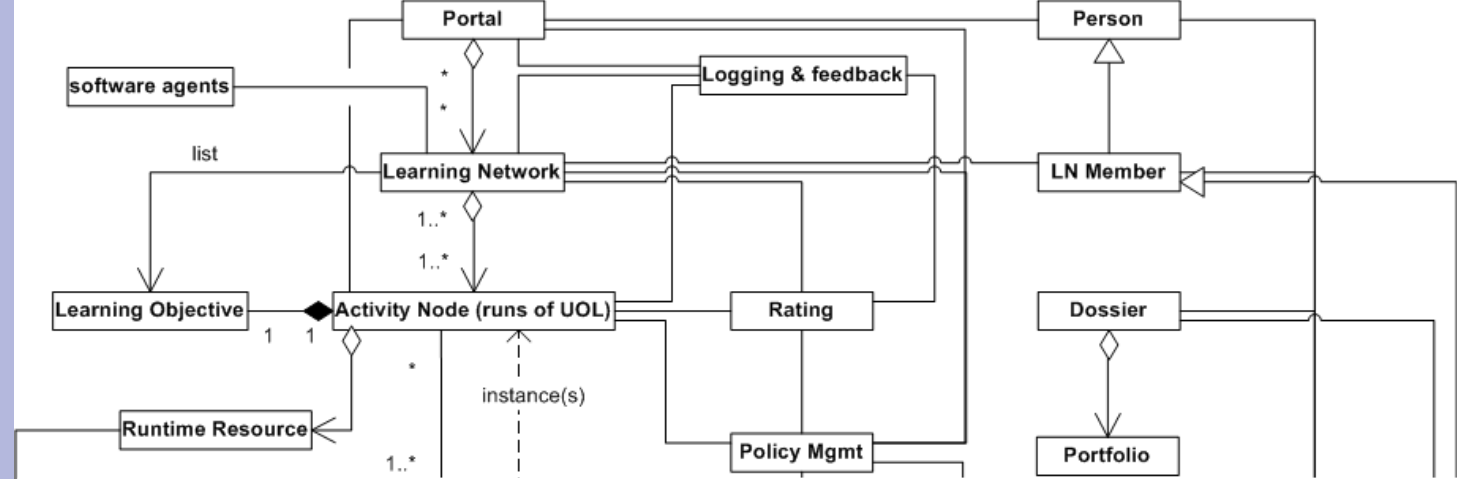


What are the functional components
that can be identified in a Learning
Network Infrastructure?

=> Architectural Model

Architecture

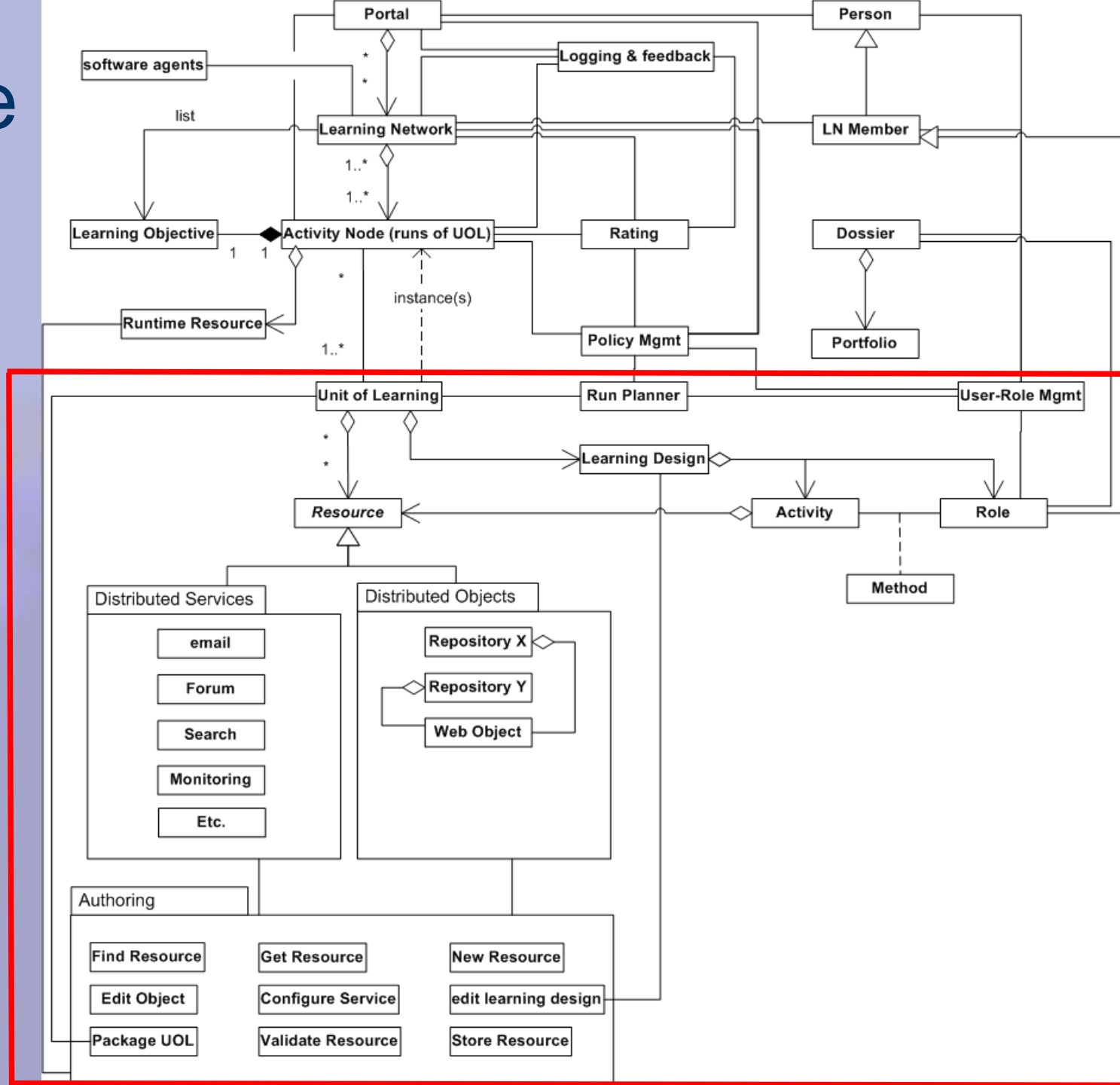
(see:
special issue
BJET
Technology
& Lifelong
Learning
Nov. 2004)



Architecture

(see:
special issue
BJET
Technology
& Lifelong
Learning
Nov. 2004)

LD tools



Three Core Issues in a Learning Network

1. How to **make & use** pedagogical well designed, interoperable and reusable units of learning in the LN?
2. How to **position** learners in a LN?
3. How to help learners to **navigate** in the LN?

ad 1. Make & Use Units of Learning

- **IMS Learning Design** is used to model the units of learning within the LN
- **User-friendly Tools editing, cm, runtime**
- **Quality mechanisms** to support the building and identification of high quality units of learning
- **Community Policies** to stimulate authoring, use and reuse
- ...

Variety of Projects in the Programme (ASA, Alfabet, CopperCore, Unfold, Telcert, Jisc/open framework project)

ad 2. Learner Positioning

- Interoperable, secure **ePortfolios**
- **Assessment** issues (e.g. of informal required competences)
- **Mapping** of competences of individuals between different, but comparable learning networks
- Formal **accreditation** and examination issues
- **We are looking at:** integrative test framework, renewal, extension of QTI, LSA to support positioning

Projects: testing framework, revision QTI in IMS

ad 3. Now in more detail:
How to setup **Navigational** support
within a Learning Network

Navigation questions within LNs

- I want to know something more about topic X, is there an adequate unit of learning available?
- What is, for me, the best route to attain a certain learning objective (or certificate, diploma, ...)?
- I have done X and Y, what would you advise me to do next?
- ...

Problems with navigation in LNs

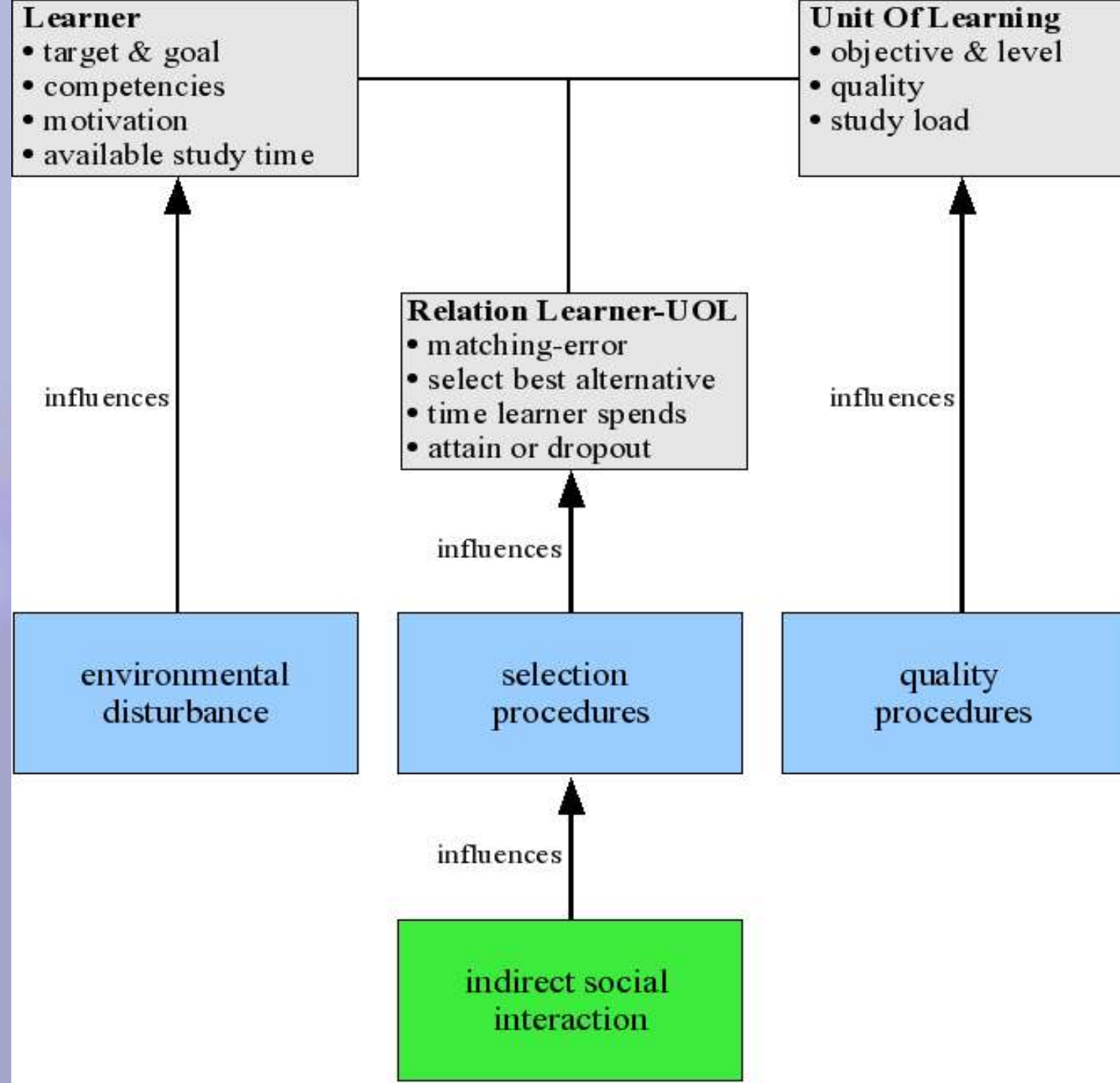
- In any field per definition a very ***large number*** of possible units of learning,
- of a *variable quality*
- The number of units of learning *change* rapidly over time
- Nobody has a real *overview* of actual quality, number of possibilities, ...

So,
How to Organize a Learning
Network under such constraints?

Our Approach

- Use of self-organisation principles from complexity theory, specifically principles of indirect social feedback ('stigmercy')
- Use of bio-inspired theories ('pheromones')
The paths of successful predecessors are used for advice

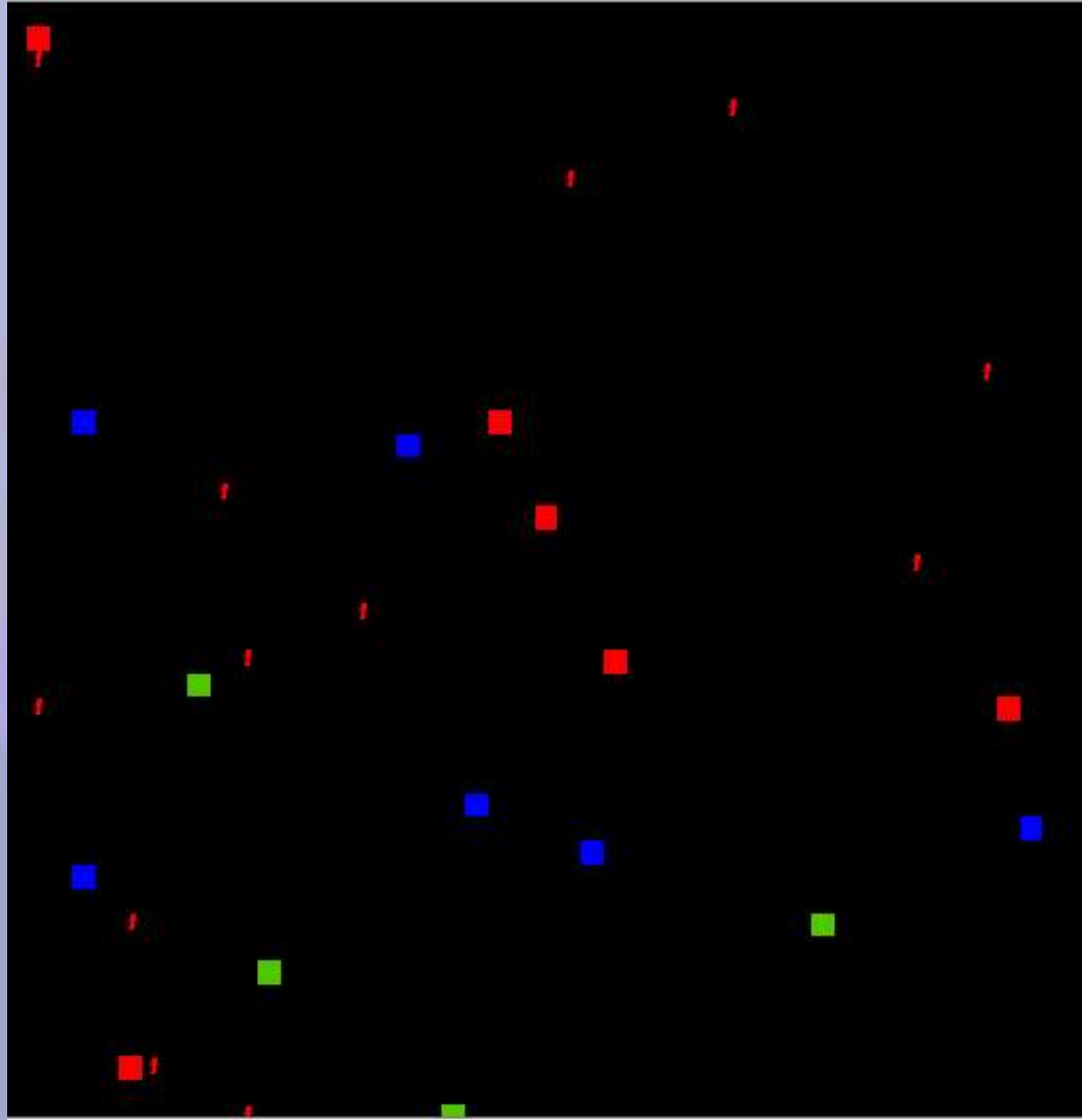
Model



Netlogo Simulation of a LN

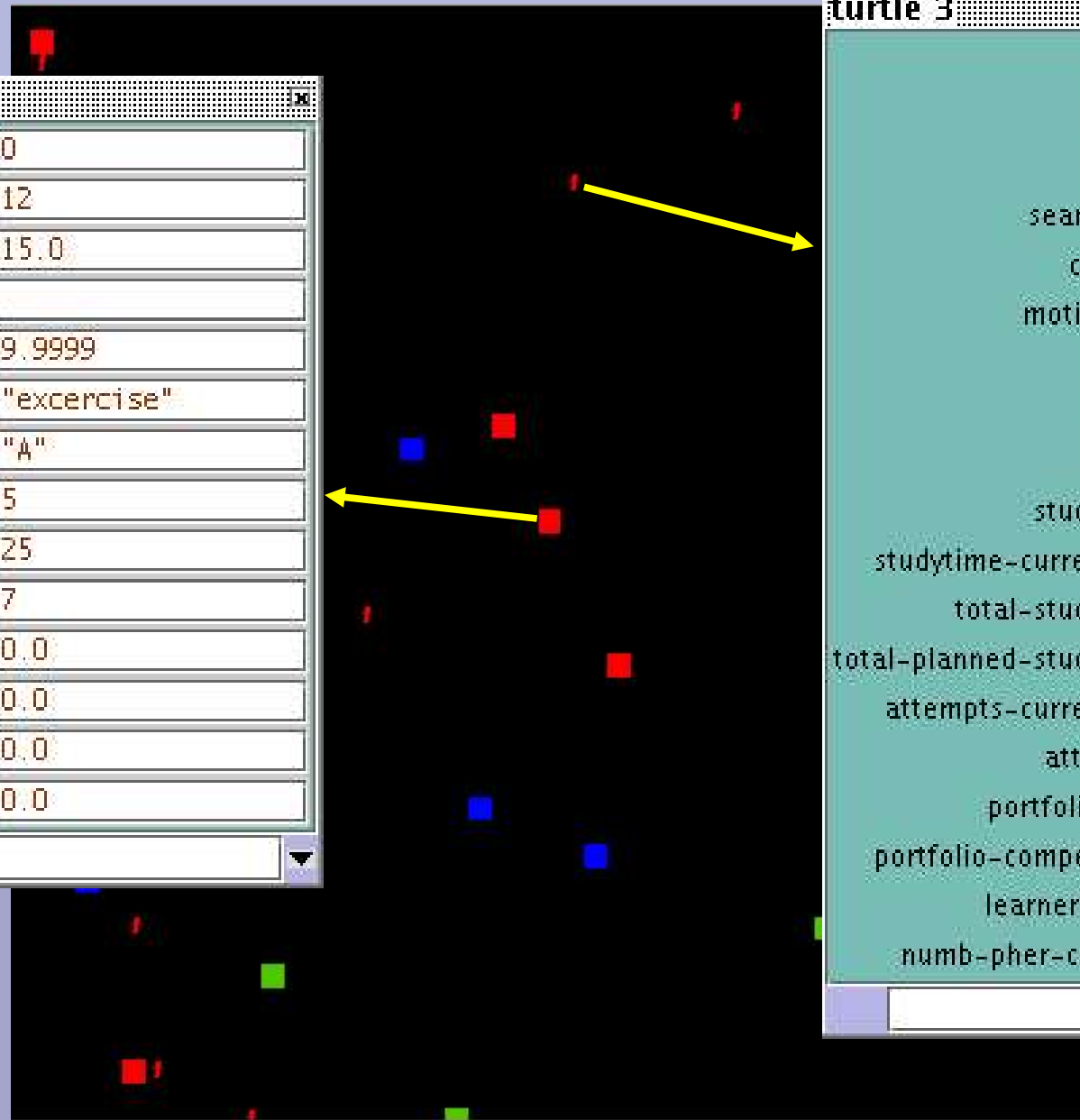
- **Multi-agent simulation environment for research**
- **See Draft publication in handouts**

Learners + Units of Learning in a LN



Properties

patch 0 12	
pxcor	0
pycor	12
pcolor	15.0
plabel	
plabel-color	9.9999
an-type	"exercice"
an-objective	"A"
an-level	5
an-studytime	25
an-quality	7
an-student-contribution	0.0
an-number-started	0.0
an-number-succeeded	0.0
an-avg-studytime	0.0



turtle 3	
goal	[["B" 2]]
target	["B" 2]
to-do	0.0
search-an	["B" 2]
current	"searching"
motivation	.4727094179075353
cl-a	0
cl-b	1
cl-c	1
studytime	15
studytime-current-an	0
total-studytime	4.681044239829234
total-planned-studytime	45.0
attempts-current-an	0
attempts	1.0
portfolio-ans	[[-12 -7]]
portfolio-competence	[["B" 1]]
learner-costs	209.0
numb-pher-choices	0.0

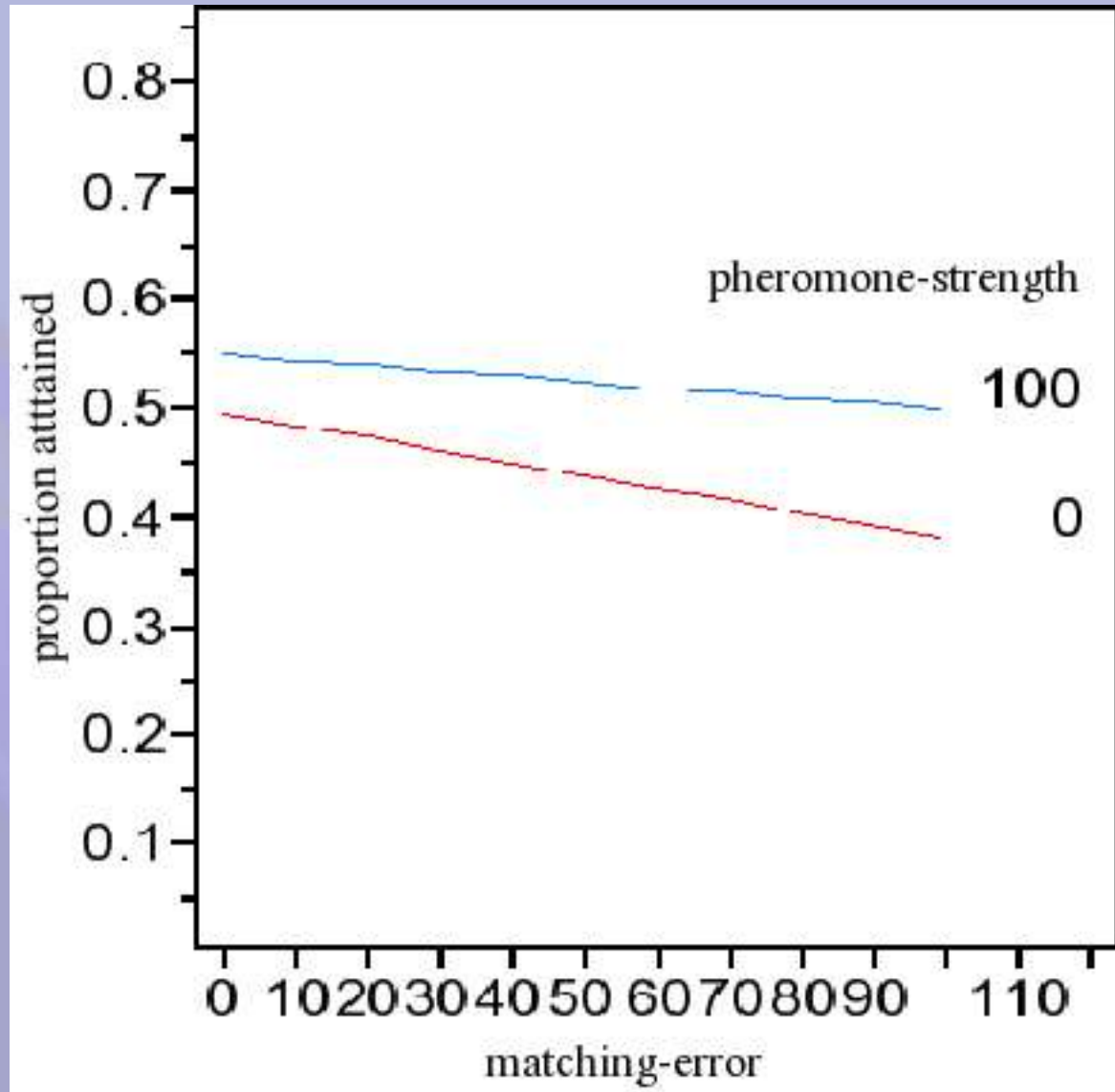
One of the Experiments with the Simulation

- Problem: what is the effect of indirect navigational feedback on study success (number of students that attained objective)?
- 2^4 factorial design:
 - pheromone strength (0 or 100%)
 - matching error (0 or 100%)
 - disturbance in learner environment (0 or 100%)
 - quality of the unit of learning (0-100% or 100%)
- N=12 replications in every condition
- Every replication runs 260 simulation weeks (5 years). In total 49920 week cycles (runs about 10 hours on fast computer)

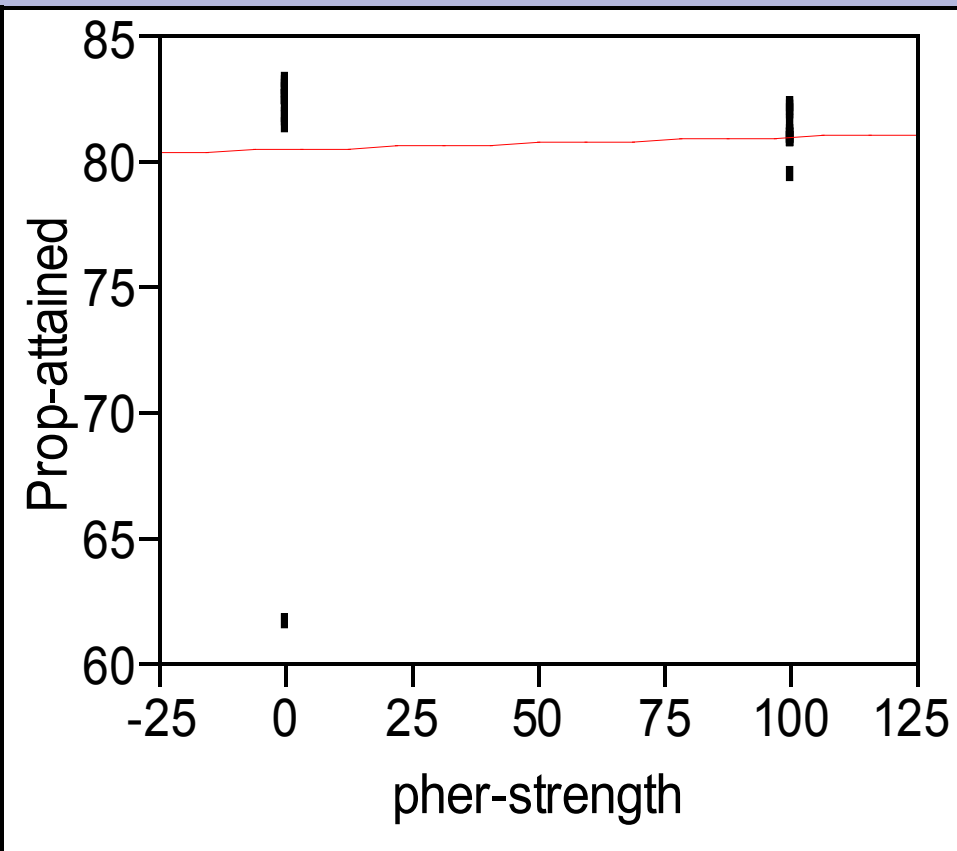
Outcome

- All main effects significant + interactions:
pher-strength * matching error
pher-strength * quality of unit of learning

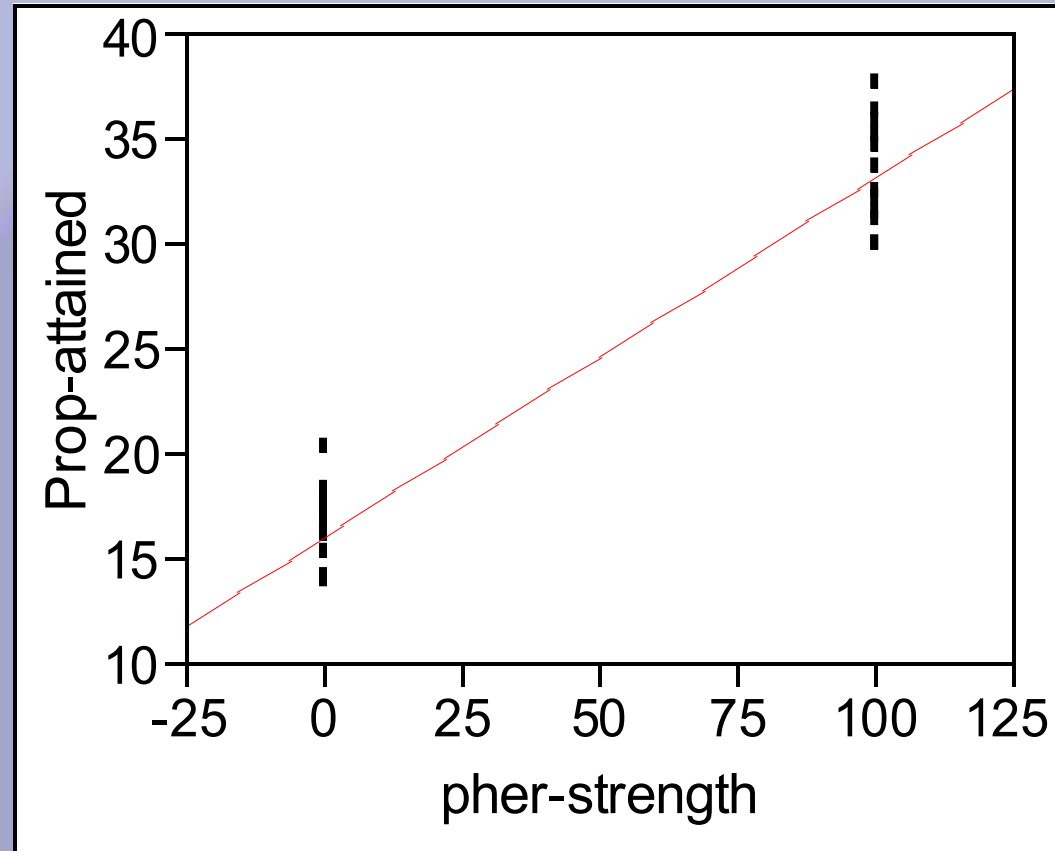
Interaction Pher * Matching-error



best versus worst case



no matching error, 100% quality
and no disturbance ($F = 0.7816$)



100% matching error, 0% quality
and 100% disturbance ($F = <.0001$)

Outcome

- Overall influence Pheromones: 9% increase in proportion of students who attained their objective
- Matching-errors are compensated by pheromones
- Some quality variance is compensated by pheromones

more details: see paper in current issue of the Journal of Artificial Societies and Social Simulation (JASSS)

Thank You

More info:

www.learningnetworks.org

dspace.ou.nl