# Exploiting Synergy Between Ontologies and Recommender Systems

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# Exploiting Synergy Between Ontologies and Recommender Systems

- Cold-start and interest acquisition problems
- Quickstep architecture and approach
- OntoCoPI approach
- Integration of Quickstep, Ontology and OntoCoPI
- Empirical evaluation
- Issues arising from empirical evaluation
- Future work



# Exploiting Synergy Between Ontologies and Recommender Systems

- **Cold start and interest acquisition problems**

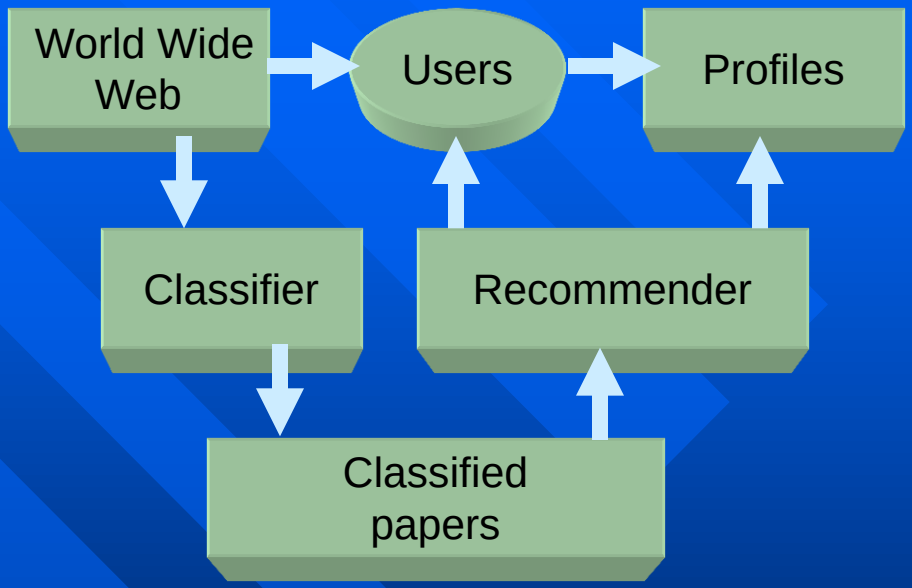
Recommender systems reduce WWW information overload
- Observe behaviour to profile user interests
- Suffer from cold-start problems
- New-system and new-user cold start

Ontologies hold knowledge about a domain
- Domain knowledge held is commonly static in nature
- Acquiring ever changing interests is challenging

Synergy between ontologies and recommender systems
- Ontologies can bootstrap recommender systems
- Recommender systems can acquire interests for an ontology

# Exploiting Synergy Between Ontologies and Recommender Systems

- **Quickstep architecture and approach**




Research papers
- TF vector representation
- Research topic ontology

Classifier
- k-nearest neighbour
- Users can add examples

Classified paper database
- Grows as users browse

Profiler
- Feedback and browsed papers give time/interest profile
- Time decay function computes current interests

Recommender
- Recommends new papers on topics of interest

# Exploiting Synergy Between Ontologies and Recommender Systems

- **OntoCoPI approach**

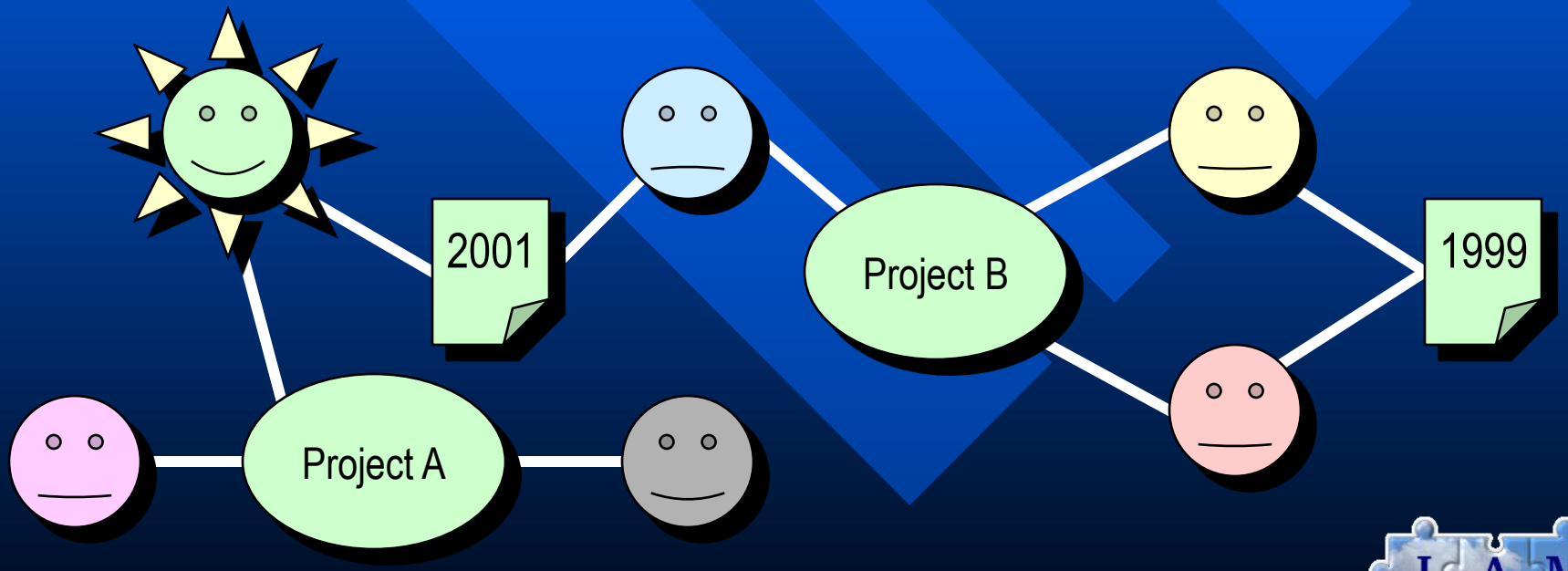
Identifies communities of practice using an ontology

Informal groups of individuals sharing an interest

Network analysis applied to a populated ontology

Breadth-first search over selected relationships

Discovers connections that infer common interest



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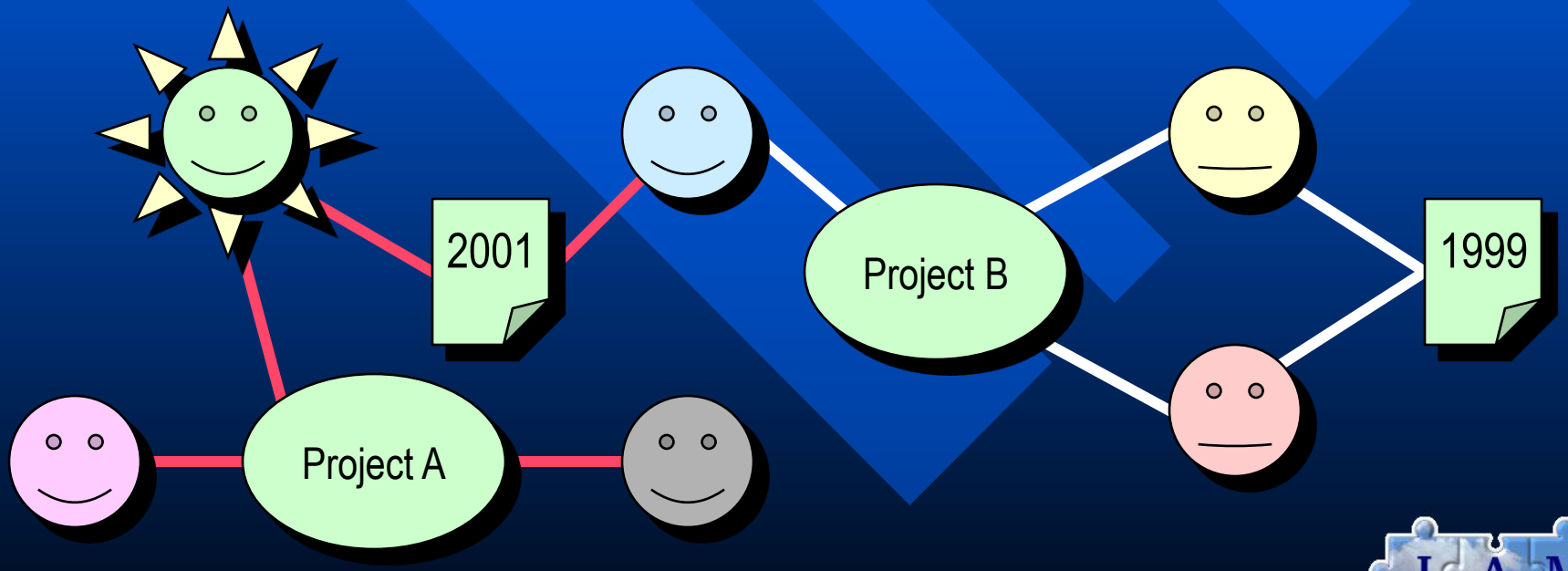

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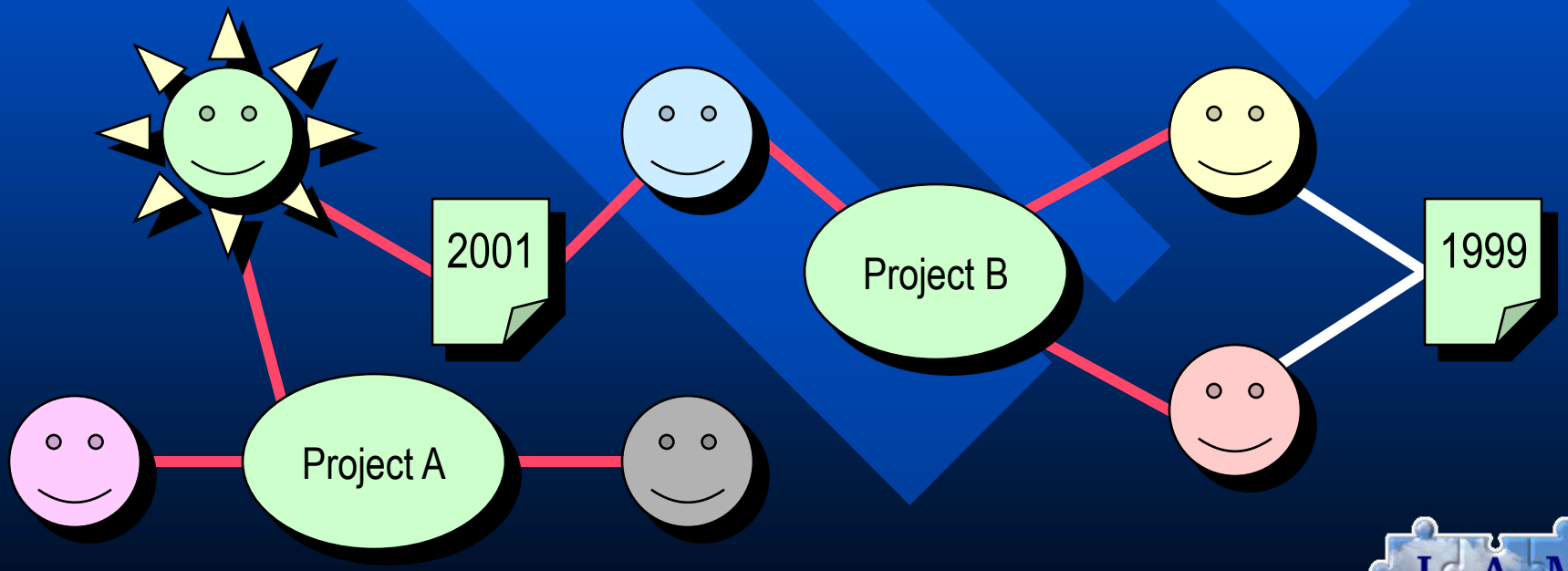
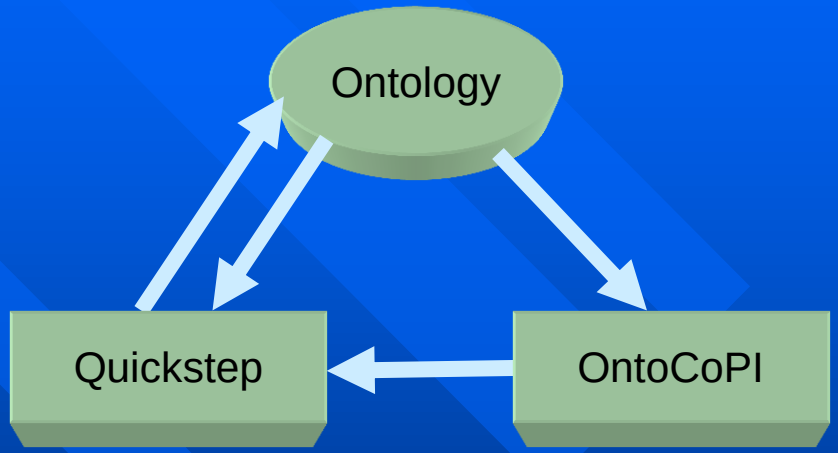


# Exploiting Synergy Between Ontologies and Recommender Systems

- **Integration of Quickstep, Ontology and OntoCoPI**

New-system cold start

Ontology bootstraps new-system profiles



# Exploiting Synergy Between Ontologies and Recommender Systems

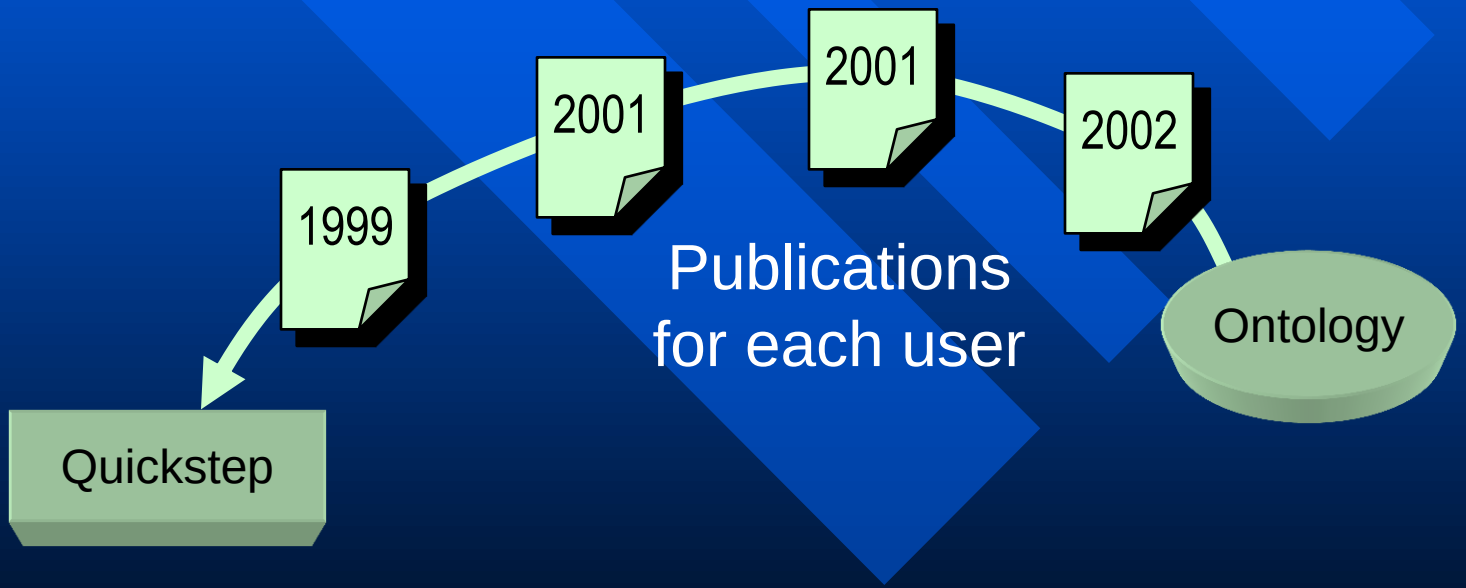
- **Integration of Quickstep, Ontology and OntoCoPI**

New-system cold start

Ontology provides each user's publications

Quickstep computes publication topic classifications

Bootstrap profile is computed from publication topics



# Exploiting Synergy Between Ontologies and Recommender Systems

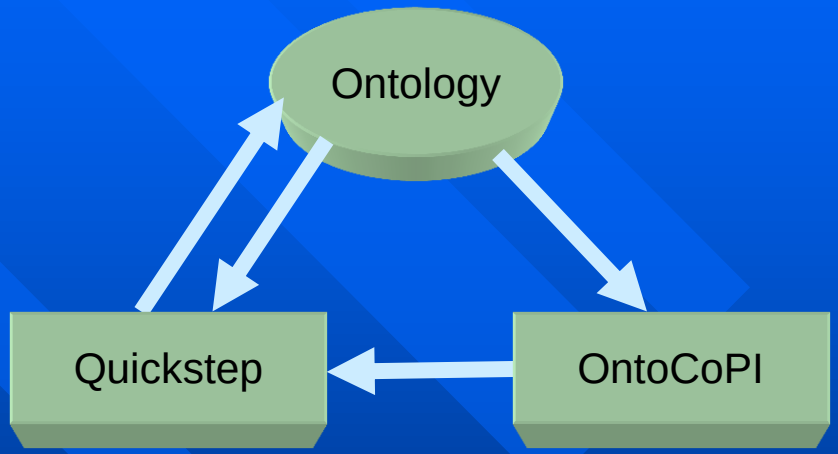
- **Integration of Quickstep, Ontology and OntoCoPI**

New-system cold start

Ontology bootstraps new-system profiles

New-user cold start

OntoCoPI and Ontology bootstraps new-user profiles



# Exploiting Synergy Between Ontologies and Recommender Systems

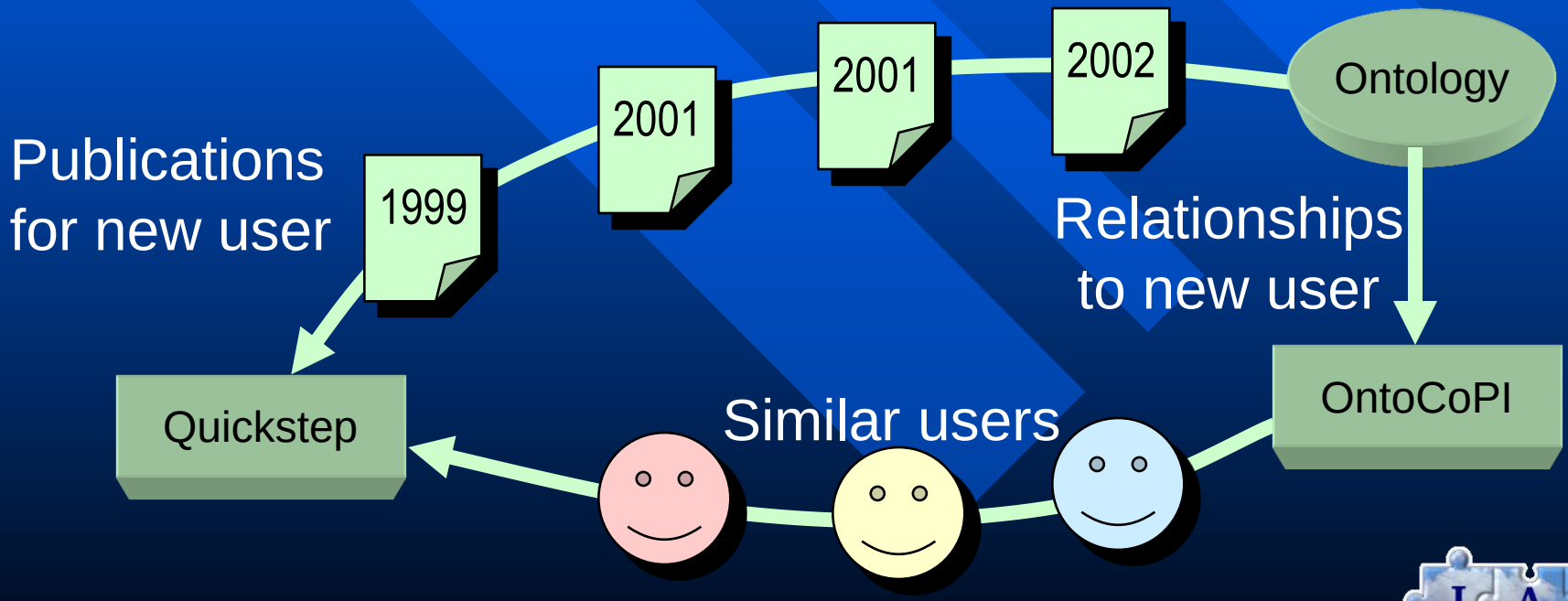
- **Integration of Quickstep, Ontology and OntoCoPI**

  New-user cold start

  Ontology provides new user's publications

  OntoCoPI provides a set of similar user's to the new user

  Bootstrap using similar profiles and previous publications



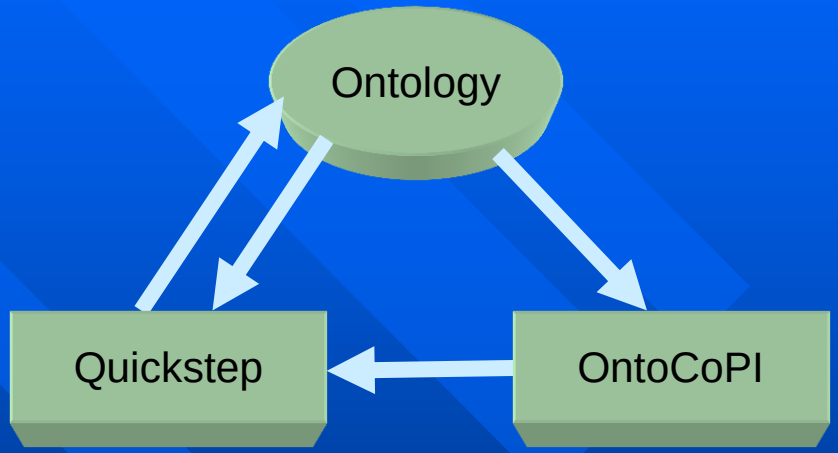
# Exploiting Synergy Between Ontologies and Recommender Systems

- **Integration of Quickstep, Ontology and OntoCoPI**

New-system cold start
- Ontology bootstraps new-system profiles

New-user cold start
- OntoCoPI and Ontology bootstraps new-user profiles

Interest acquisition
- Recommender updates ontology interests every day




Example profile

1st April 2002, Recommender Systems, 6.0
1st April 2002, Interface Agents, 2.9
1st April 2002, Agents, 0.9

2nd April 2002, Recommender Systems, 5.0
2nd April 2002, Interface Agents, 2.6
2nd April 2002, Agents, 0.8
…

# Exploiting Synergy Between Ontologies and Recommender Systems

- **Empirical evaluation**

Measured the reduction in the recommender cold-start
Used logged browsing behaviour from a real trial
    Quickstep trial logs, 9 users, first 7 weeks of browsing used
Measured convergence to a post cold-start state
    Week 7 used for post cold-start state
    New-system bootstrap performance measured
    New-user bootstrap performance measured

| | Precision | Error rate |
|---|---|---|
| New-system bootstrapping | **0.35** | **0.06** |
| New-user bootstrapping | **0.84** | **0.55** |

# Exploiting Synergy Between Ontologies and Recommender Systems

- **Issues arising from empirical evaluation**

Is the cold-start overcome?

- New-system bootstrapping works well
  - Old interests were correctly identified
  - Recent interests harder to get from publications
- New-user bootstrapping too error prone
  - Communities of practice were not focused enough
  - Not selective enough when taking similar users interests

Is the interest-acquisition problem overcome?

- Up-to-date interest profiles are acquired daily
- Once the cold-start is over, profiles closely match behaviour

# Exploiting Synergy Between Ontologies and Recommender Systems

- **Issues arising from empirical evaluation**

How does the quality of the ontology effect the quality of the communities of practice identified?

- Ontology was only partially populated
- We only used users who had previous publications
- OntoCoPI relationship weights not custom to our problem

Can the new-user algorithm be significantly improved?

- Could pick topics only a majority of similar users like
- OntoCoPI confidence values can weight user similarity

What other information sources could be used?

- Other university databases
- Structured web pages with associated metadata

# Exploiting Synergy Between Ontologies and Recommender Systems

- **Issues arising from empirical evaluation**

Will our approach work with other problem domains?

- Classifier needs textual information sources
- User behaviour must be monitored
- Need an ontology for the domain
- Classifier needs a new training set of class examples

# Exploiting Synergy Between Ontologies and Recommender Systems

- **Future work**

Further recommender / ontology experimentation
- Improve the set of relationships and weights used
- Find a better new-user algorithm
- Conduct further trials with some more users
- Look into profiling context and task structure

Foxtrot recommender system
- Year long trial, over 100 staff and students
- Searchable paper database with recommendation facility
- Users can visualize and update their own profiles

OntoCoPI
- Prototype enhanced and developed further
- Evaluation planned with people in the IAM lab

# Exploiting Synergy Between Ontologies and Recommender Systems

- **Quickstep architecture and approach**

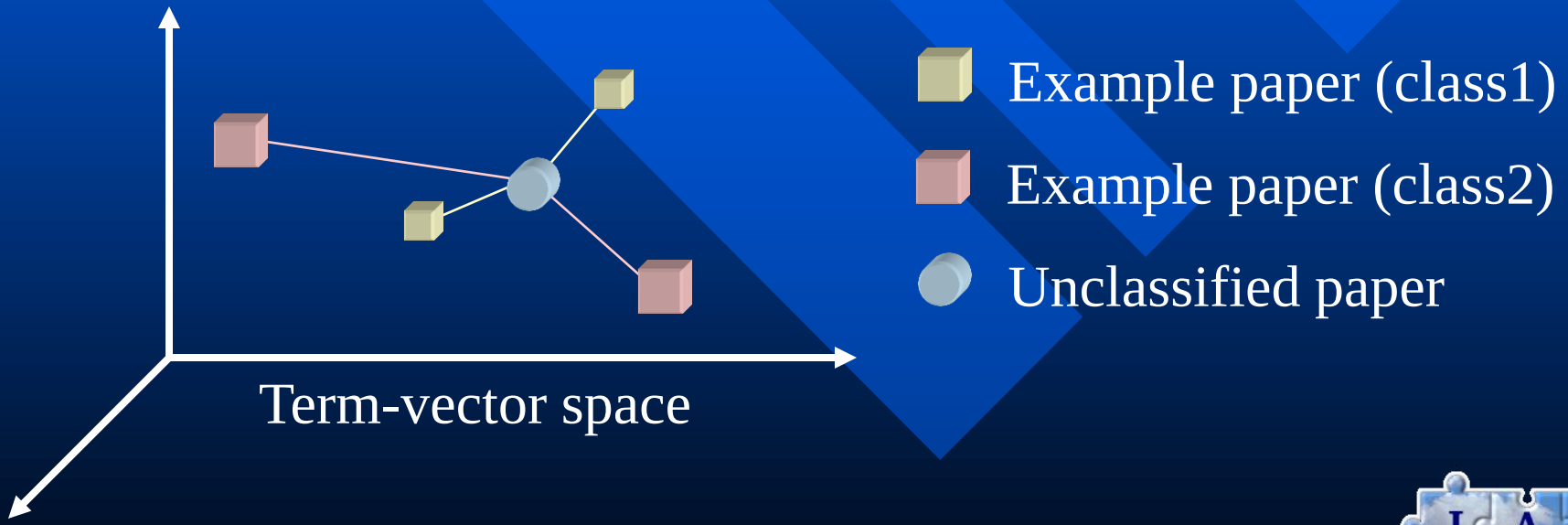
K-Nearest Neighbour - kNN

TF vector representation

Examples exist in a term-vector space

New papers are added to this space

Classification is a function of its ‘closeness’ to examples



# Exploiting Synergy Between Ontologies and Recommender Systems

- **Quickstep architecture and approach**

Profiling

Time/Interest profile

Is-a hierarchy infers topic interest in super-classes

Time decay function biases towards recent interests