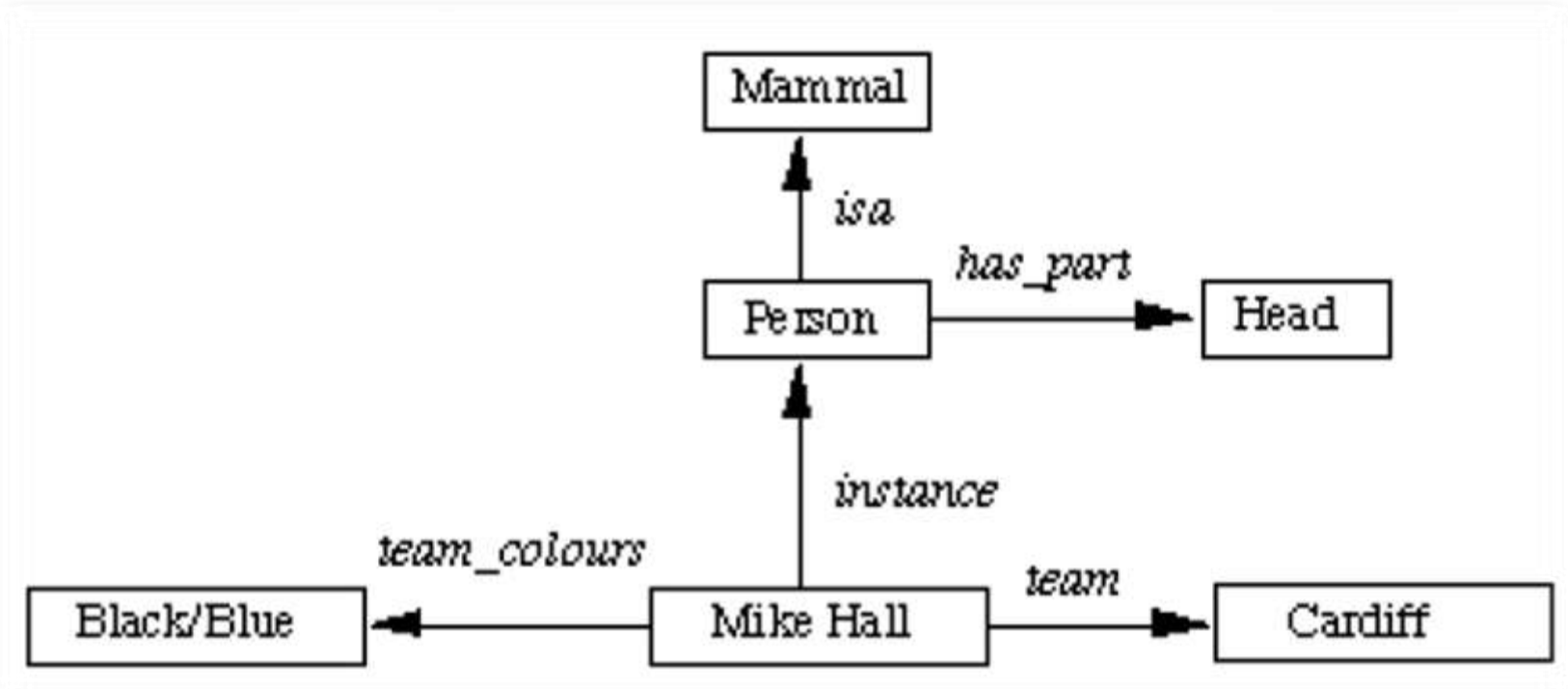
Semantic Networks

Definition

Semantic Net

- Form of knowledge representation
- Predicate logic alternative
- Labelled directed graph
- Components:
  - Nodes – object or concept
  - Links – relation between nodes.

Semantic Nets

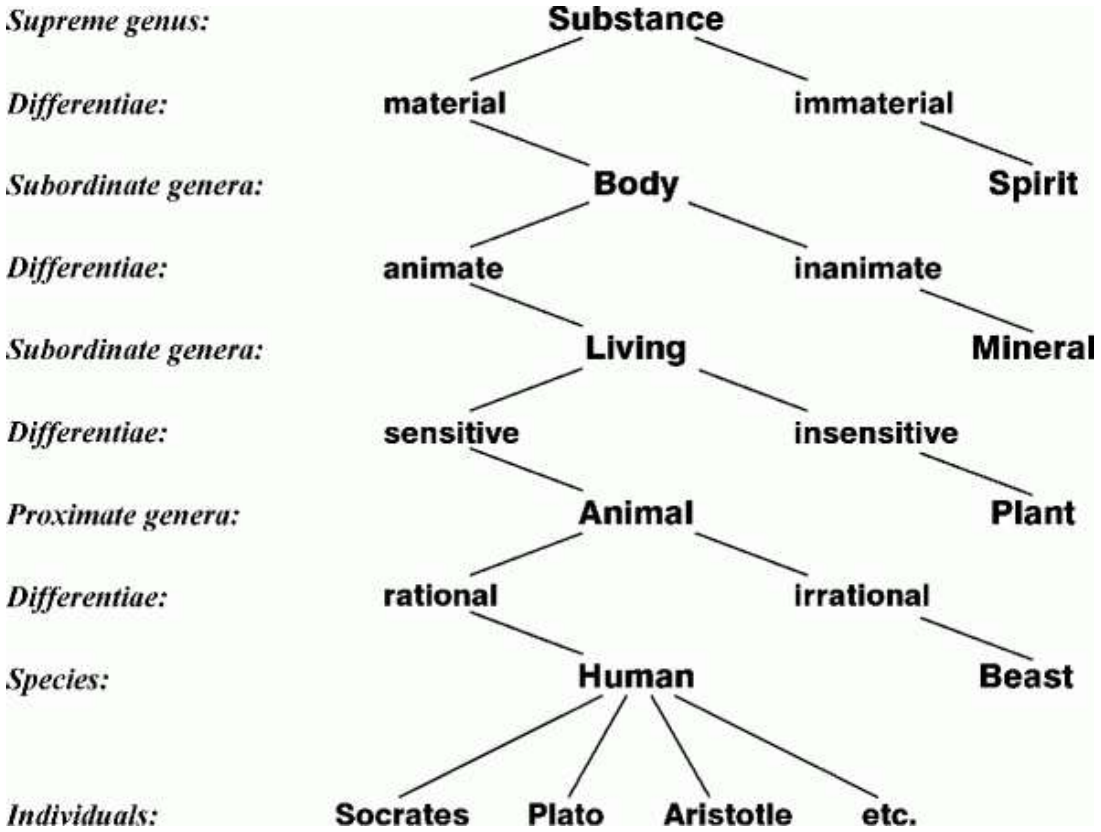


- isa(person, mammal)
- instance(Mike Hall, person)
- team(Mike Hall, Cardiff)

Kinds of Semantic Nets

Definitional Networks

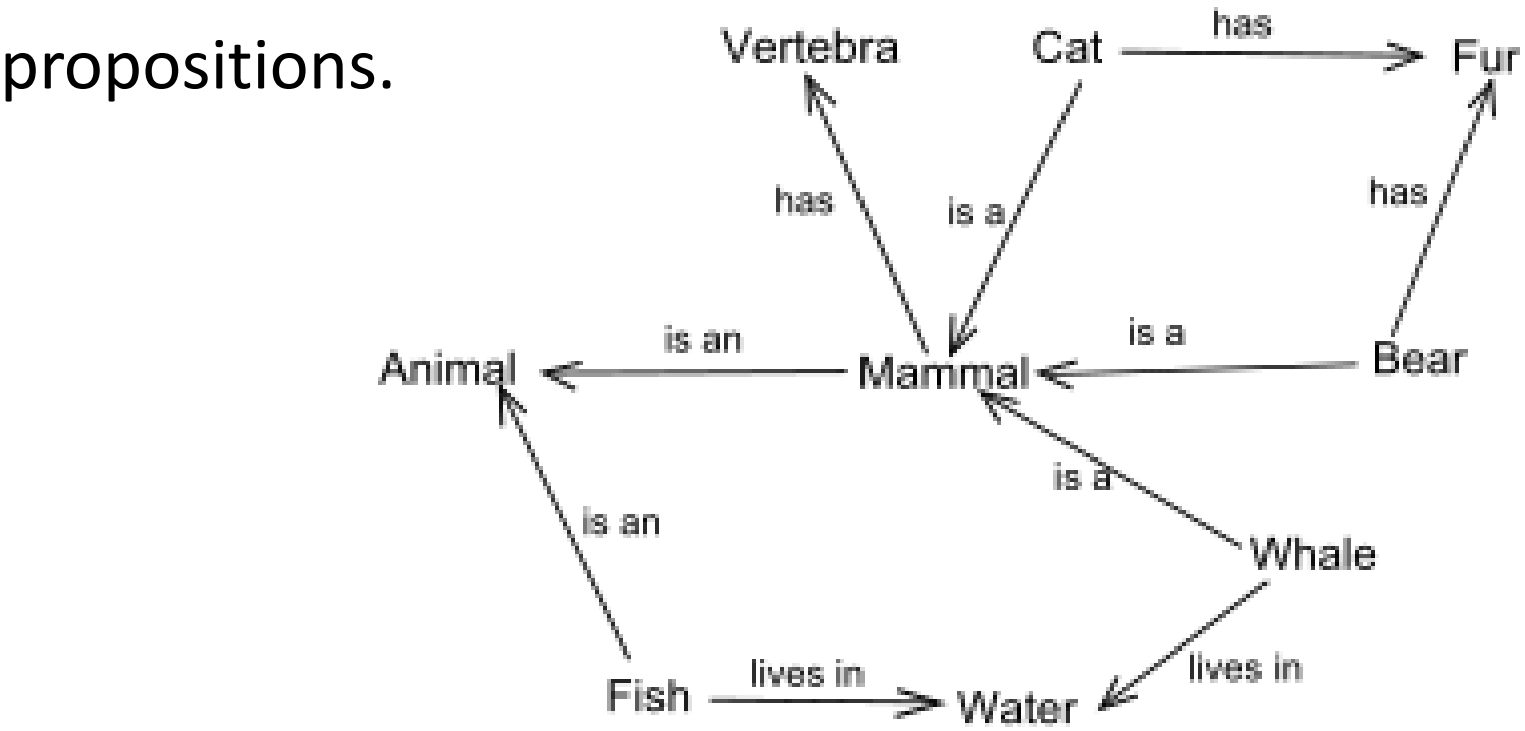
- Emphasize the *subtype* or *is-a* relation between a concept type and a newly defined subtype.



Kinds of Semantic Nets

Assertional Networks

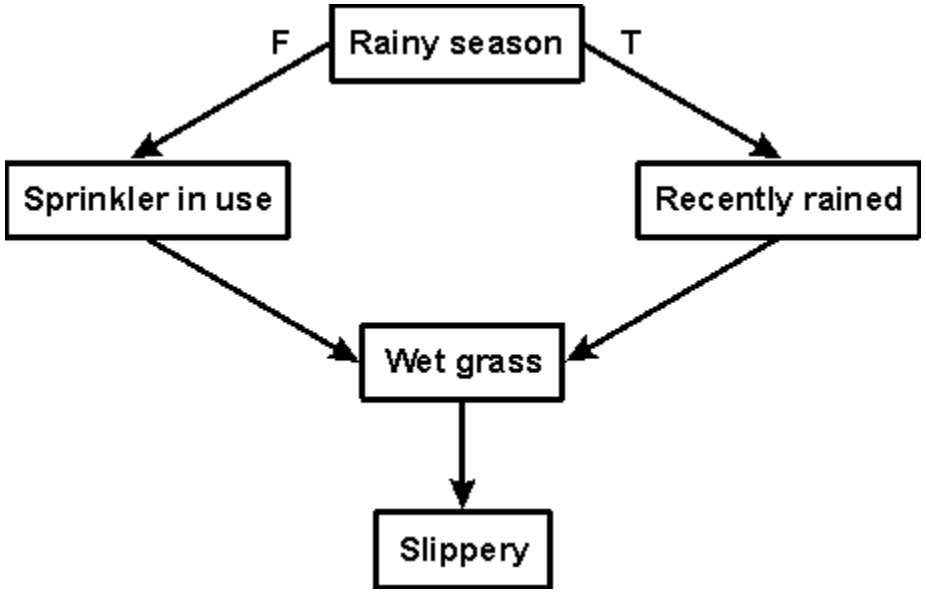
- Designed to assert propositions.



Kinds of Semantic Nets

Implicational Networks

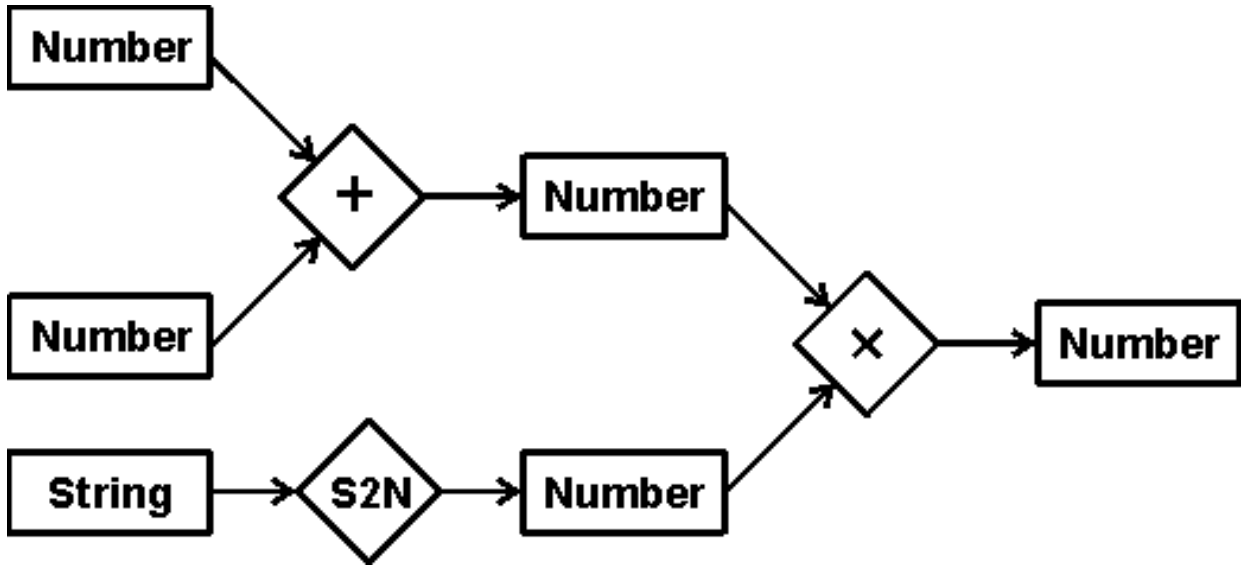
- Uses implication as the primary relation for connecting nodes.



Kinds of Semantic Nets

Executable Networks

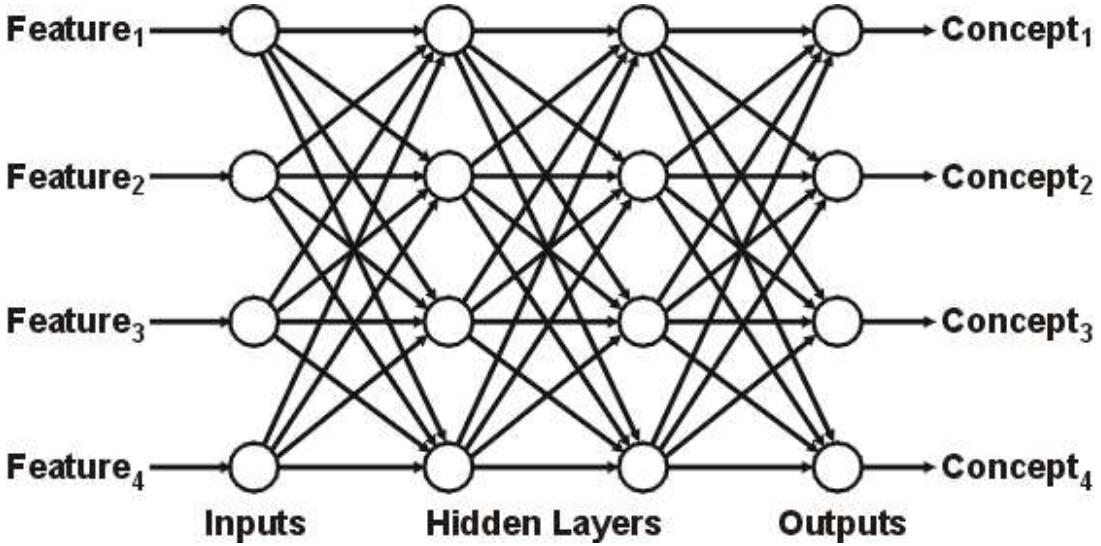
- Contain mechanisms that can cause some change to the network itself.



Kinds of Semantic Nets

Learning Networks

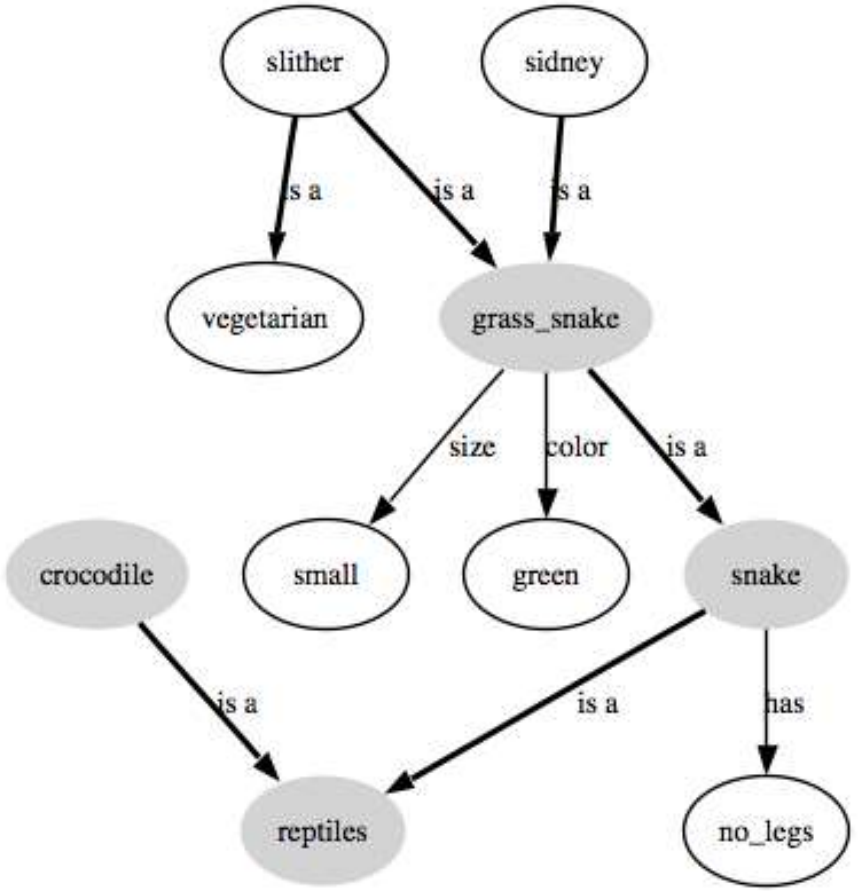
- Networks that build or extend their representations by acquiring knowledge from examples.



Kinds of Semantic Nets

Hybrid Networks

- Networks that combine two or more of the previous techniques, either in a single network or in separate, but closely interacting networks.



Semantic Relations

- Antonymy - A is the opposite of B (Cold is the opposite of warm)
- Holonymy - B has A as a part of itself (Bedroom has bed)
- Homonymy - A and B, are expressed by the same symbol. (Both a financial institution and a edge of a river are expressed by the word bank)
- Hypernymy - A is the superordinate of B. A is the general kind of B(Animal is a hypernym of dog)
- Hyponymy or troponomy - A is a subordinate of B. A is a specific kind or instance of B (Dog is a hyponym of animal)
- Meronymy - A is part of B (Engine is part of car)
- Synonymy - A denotes the same as B (Happy is synonym of blissful)

Common Semantic Relations

- There is no standard set of relations for semantic networks, but the following relations are very common:
- INSTANCE: X is an INSTANCE of Y if X is a specific example of the general concept Y.
- Example: Elvis is an INSTANCE of Human

- ISA: X ISA Y if X is a subset of the more general concept Y.
- Example: sparrow ISA bird

- HASPART: X HASPART Y if the concept Y is a part of the concept X. (Or this can be any other property)
- Example: sparrow HASPART tail

Inheritance

- A key concept in semantic networks and can be represented naturally by following ISA links.
- In general, if concept X has property P, then all concepts that are a subset of X should also have property P.

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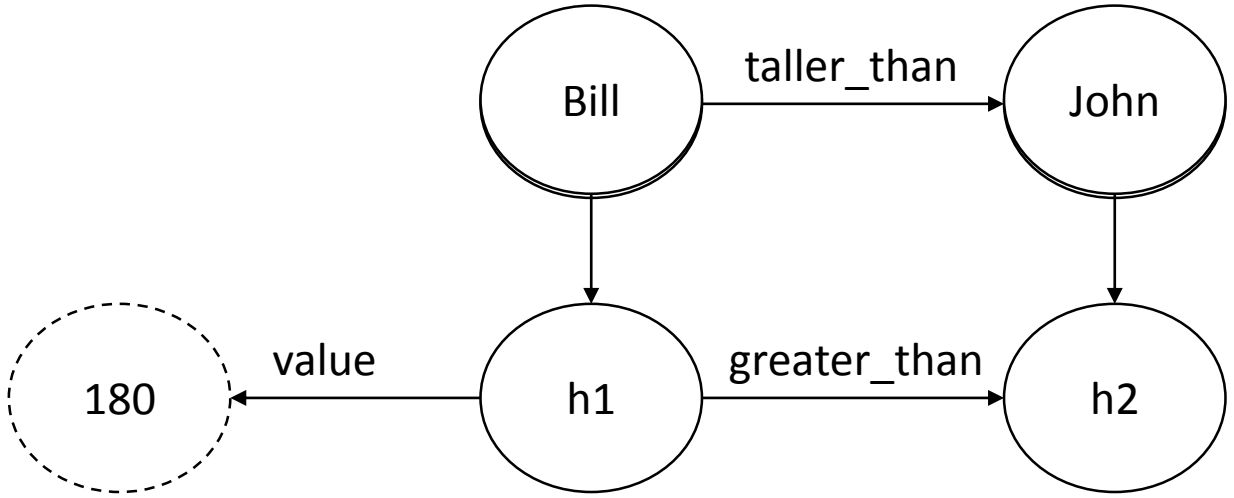
Converting to Semantic Net

Example

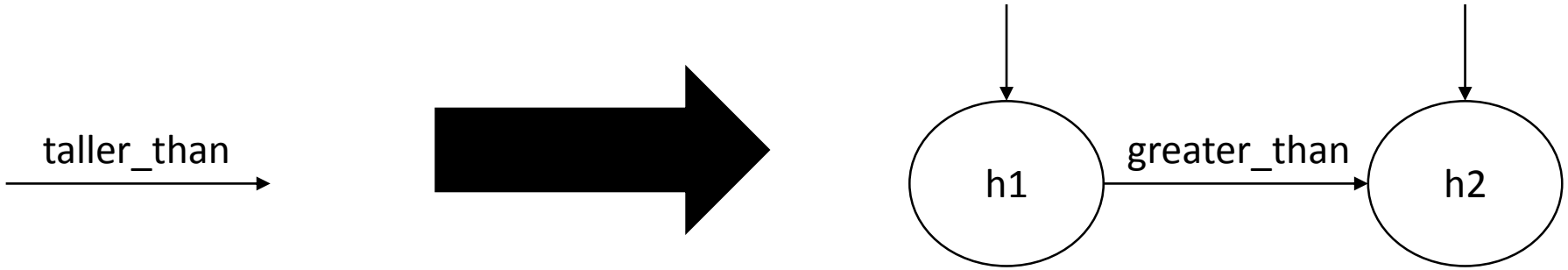
- Bill is taller than John.



nodes represent object, and arcs represent relationships between those objects

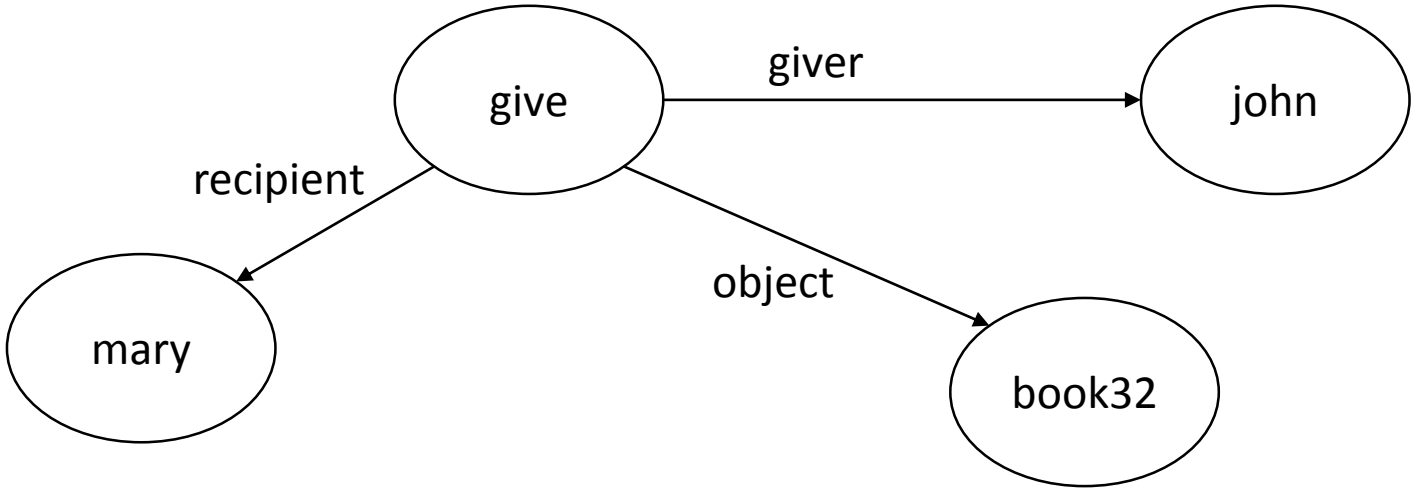
Steps

- Draw Relations on the basic of primitives
- Represent Complicated Relations with this primitives.



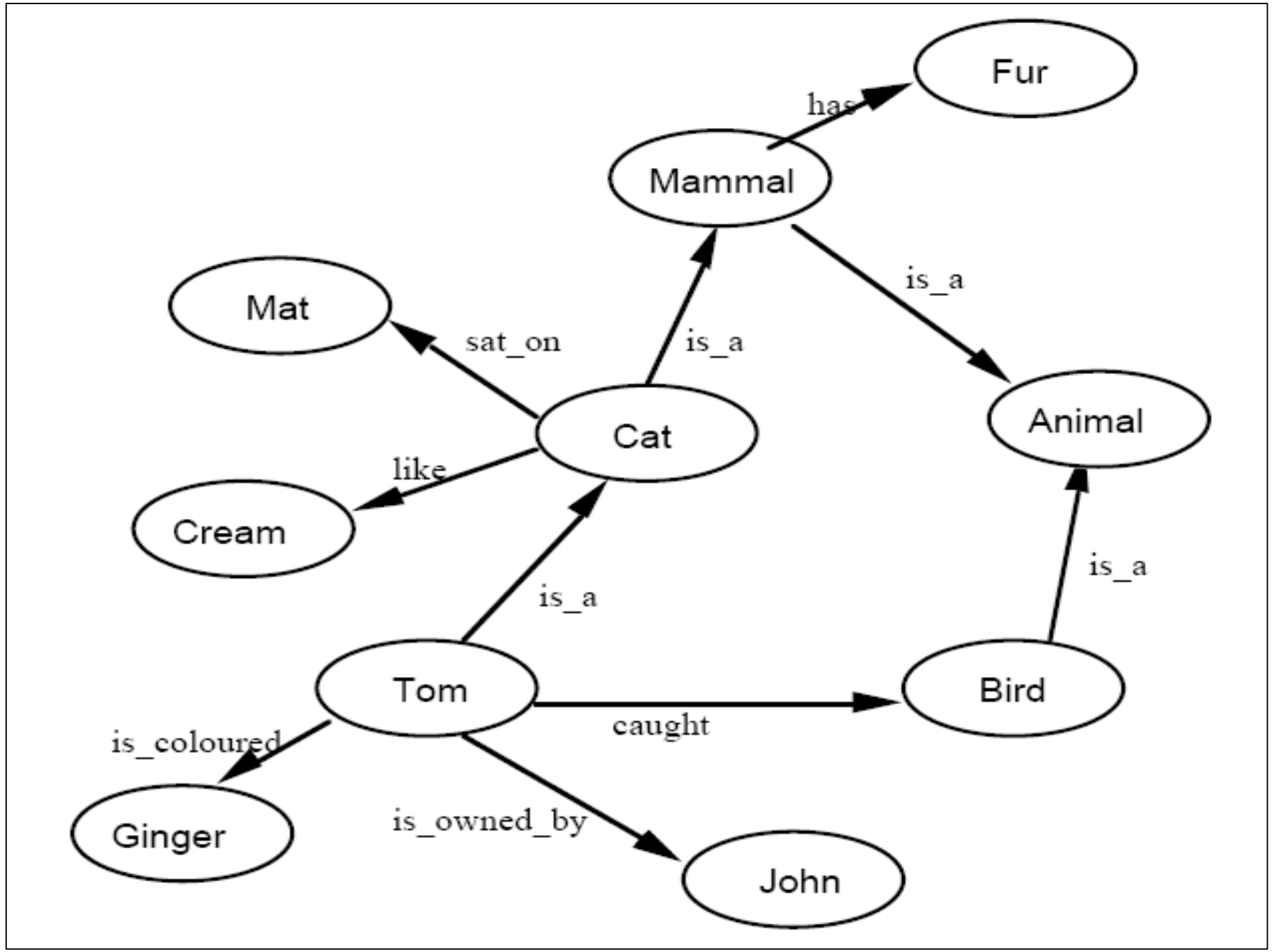
Reification

- reify v : consider an abstract concept to be real
- Non-binary relationships can be represented by “turning the relationship into an object”
- Example: a giver, a recipient and an object, give(john,mary,book32)



EXAMPLE

- Tom is a cat.
- Tom caught a bird.
- Tom is owned by John.
- Tom is ginger in colour.
- Cats like cream.
- The cat sat on the mat.
- A cat is a mammal.
- A bird is an animal.
- All mammals are animals.
- Mammals have fur.


Fur
has
Mammal
Mat
sat_on
is_a
is_a
Cat
Animal
like
Cream
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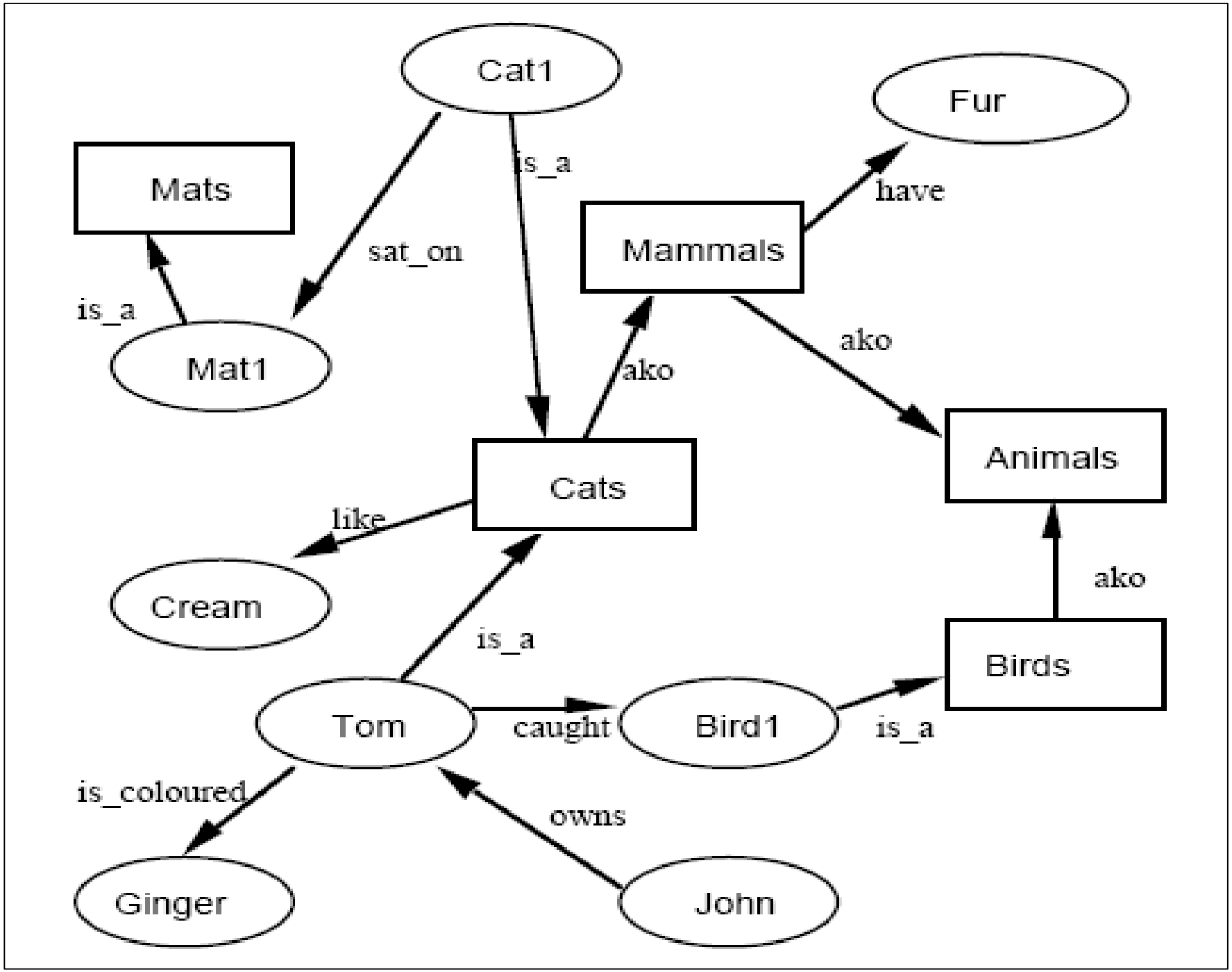
Tom
Bird
caught
is_coloured
Ginger
is_owned_by
John


Cat1
Fur
Mats
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have
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Mat1
Animals
Cats
like
Cream
ako
is_a
Birds
Tom
caught
Bird1
is_a
is_coloured
owns
Ginger
John

Disadvantages of using Semantic Nets

Disadvantages

- There is no standard definition of link names
- Semantic Nets are not intelligent, dependent on creator
- Links are not all alike in function or form, confusion in links that asserts relationships and structural links.
- Undistinguished nodes that represent classes and that represent individual objects.
- Links on objects represent only binary relations.
- Negation, disjunction and general non-taxonomic knowledge are not easily expressed.

Advantages of using Semantic Nets

Advantages

- Natural
- Modular
- Efficient
- Convey meaning in a transparent manner
- Simple
- Understandable
- Translatable to PROLOG w/o difficulty

References:

- http://www.jfsowa.com/pubs/semnet.htm