Nonmonotonic Reasoning, Weak Slot-and-Filler Structure

Semantic Net, Frames

Nonmonotonic Reasoning

- Axioms/rules are extended to make it possible to reason with incomplete information.
- These systems preserve, however, the property that at any given moment, a statement is either or not believed to be either.

Monotonic Reasoning

- It is complete to the domain of interest. All the facts that are necessary to solve a problem are present in the system or can be derived from these.
- It is consistent.
- The only way it can change is that new facts can be added as they become available.
- If these new facts that have already been asserted, then nothing will ever be retracted from the set of facts that are known to be true. This property is called monotonicity.

Nonmonotonic Reasoning

- If any of these properties not satisfied, conventional logic based reasoning systems become inadequate.
- Nonmonotonic reasoning system is designed to solve the problem in which all of these properties may be missing.
- Monotonicity is fundamental to the definition of first order predicate logic, some alternative to support nonmonotonic reasoning.

Weak Slot-and-Filler Structure

- Static representation of the things can be represented using this structures.
- Structural relationships can be represented using this structures.
- No hard and fast rule are introduced.
- Weak means poor knowledge relationship.
- Semantic Net and Frames

Semantic Net

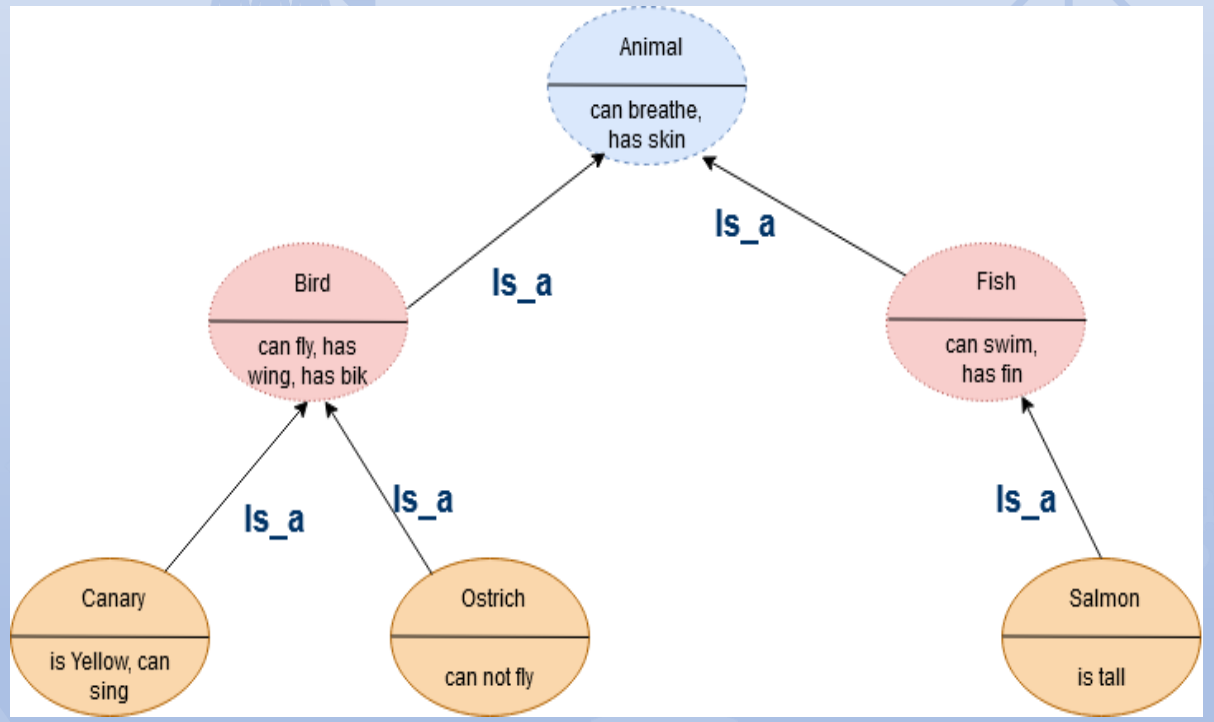
- Ross Quillian (1966 & 1968) has introduced the concepts of Hierarchical networks.
- This model was amended with some additional psychological assumption to characterize the structure of semantic network.

Semantic Net

- Concepts can be represented as hierarchies of interconnected concepts nodes(animal, bird, canary).
- Any concepts has a number of associated attributes at a given level (animal-> has skin, eats etc).
- Some concepts nodes are super-ordinates of other nodes(animal>bird)

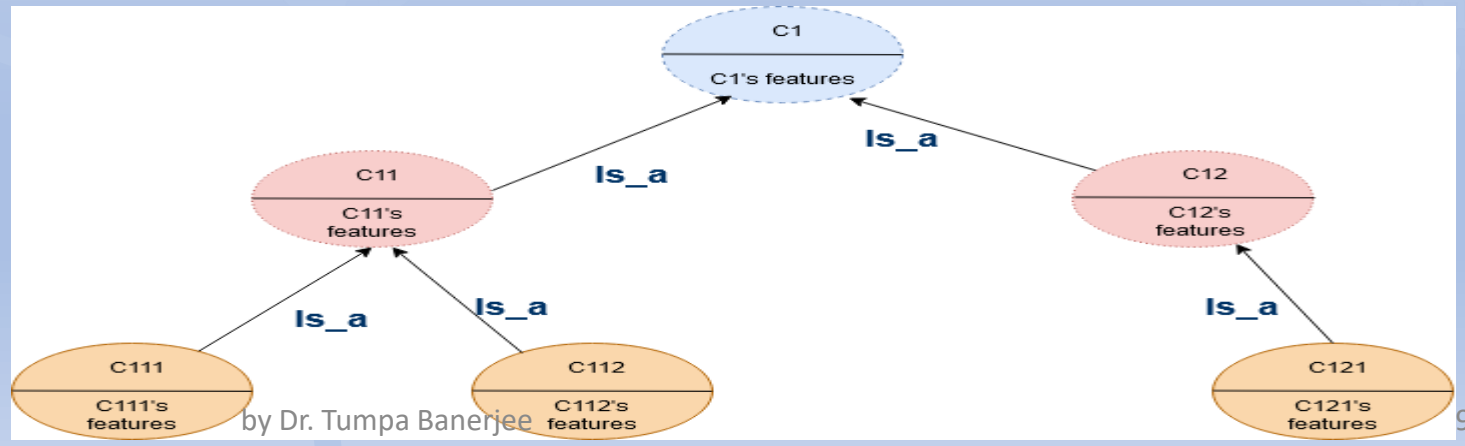
Semantic Network: Example

- Three properties have been used here
- Inheritance
- Specific can be more detailed
- Can be overridden

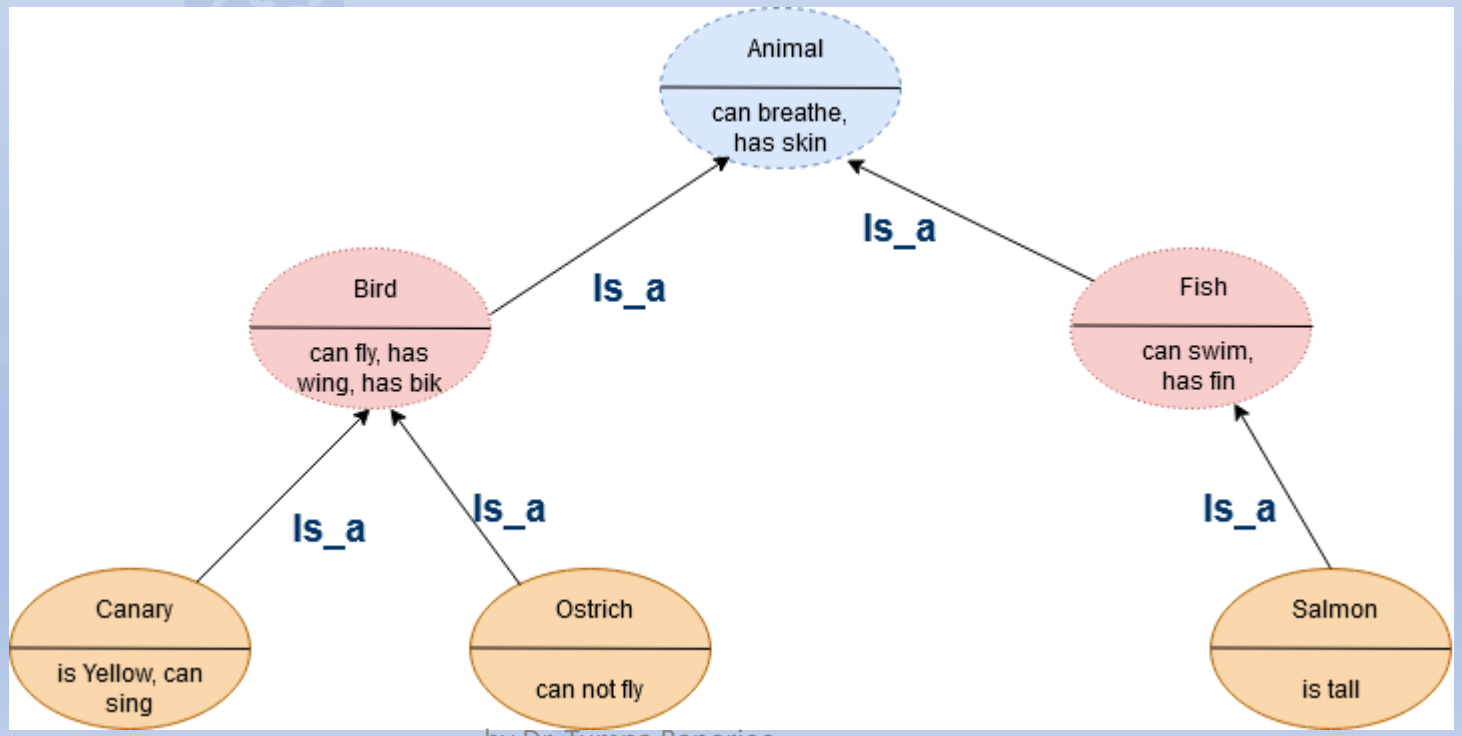


Definition of Semantic Network

- A semantic network is a structure for representing knowledge as a pattern of interconnected nodes and arcs.
- Nodes in the network represent concepts of entities, attributes, events, and values.
- Arcs in the network represent relationship that hold between concepts.



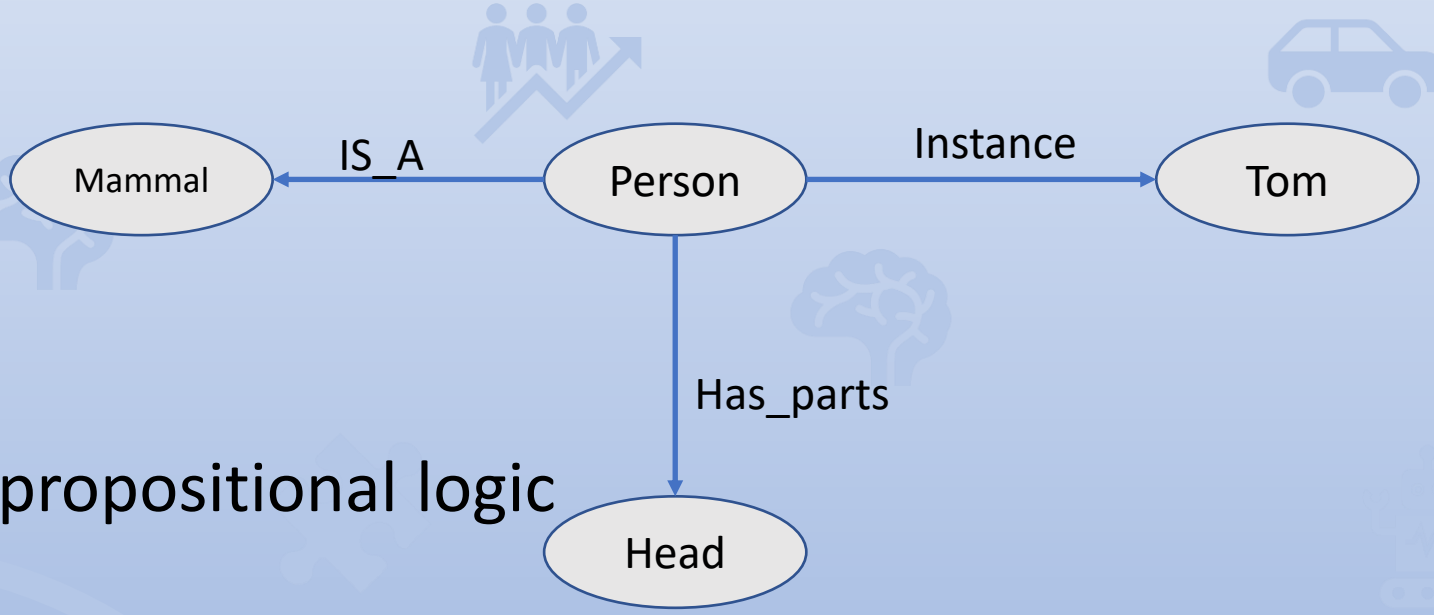
- The semantics lies not in structure alone, but also requires the relations.



Propositional logic to Semantic Network

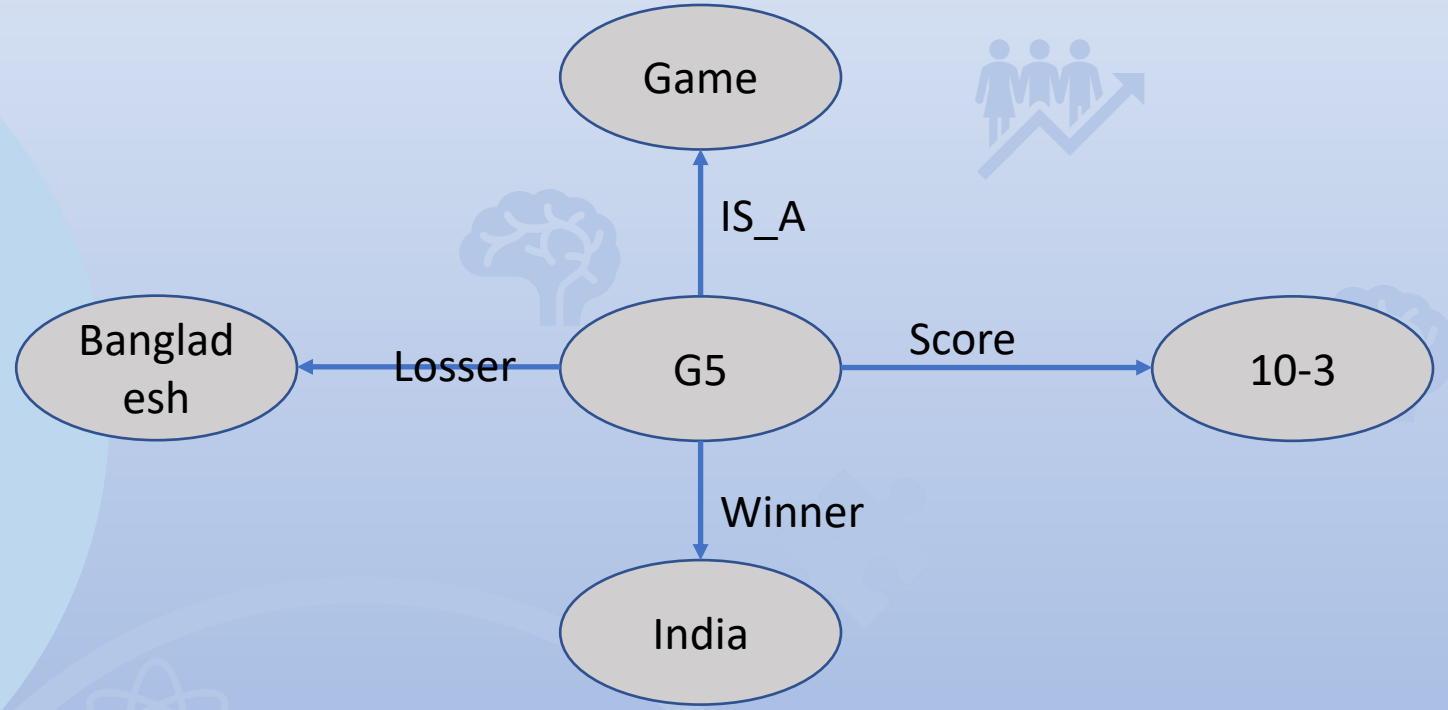
- We have represented the concept and meaning of knowledge in the form of semantic network.
- Whatever we stated using logic, am I able to represent through semantic network?
- Whatever we stated using semantic network, am I able to represent through logic?

Propositional logic to Semantic Network



Would be represented in propositional logic

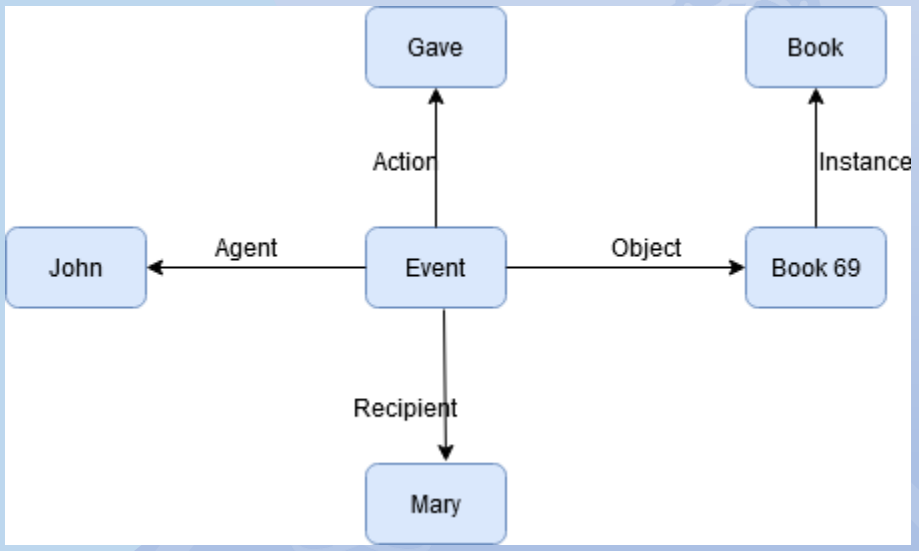
- IS_A(person,mammal)
- Instance(Tom,Person)
- Has_parts(person,Head)



- India defeated Bangladesh by 7 wicket.

Propositional logic to Semantic Network

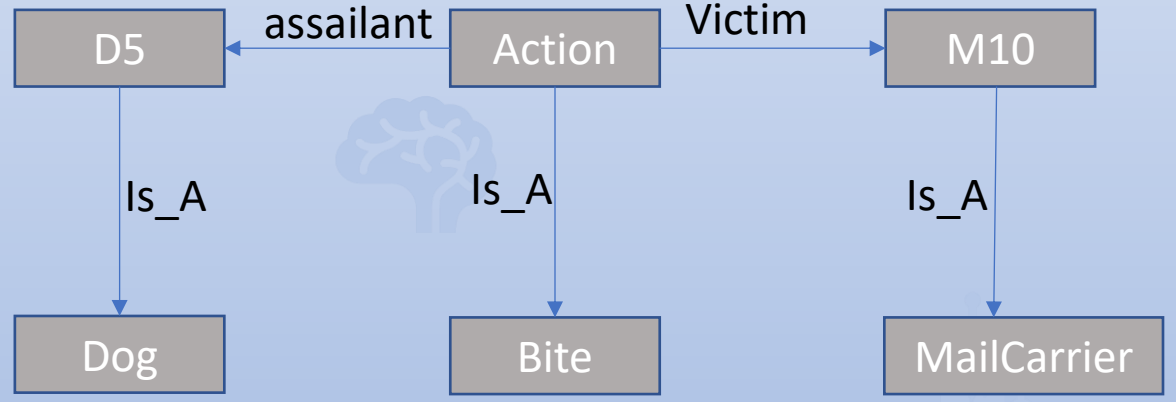
- John gave Mary the book.



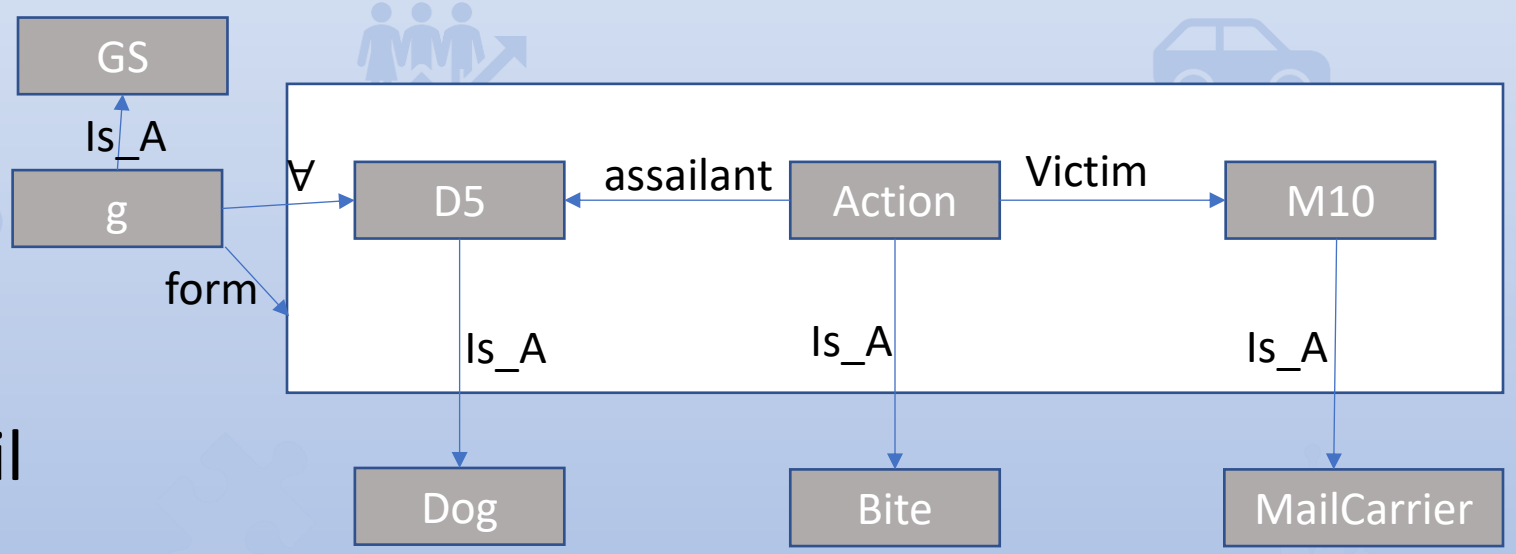
- Man(Anuraag)
- Married(Neha)
- GaveTo(Neha,Anuraag,Covid)

Propositional logic to Semantic Network

- The dog bit the mail carrier.

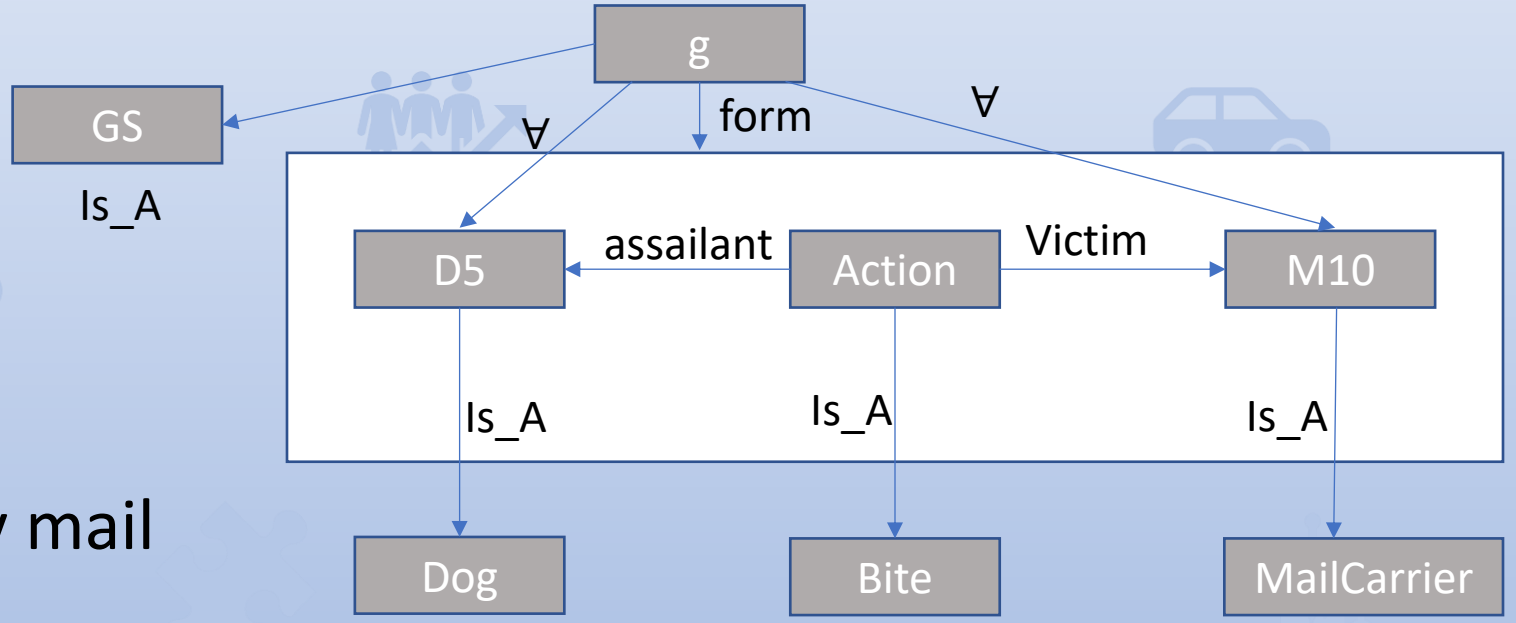


Propositional logic to Semantic Network



- Every dog has bitten a mail carrier.

Propositional logic to Semantic Network



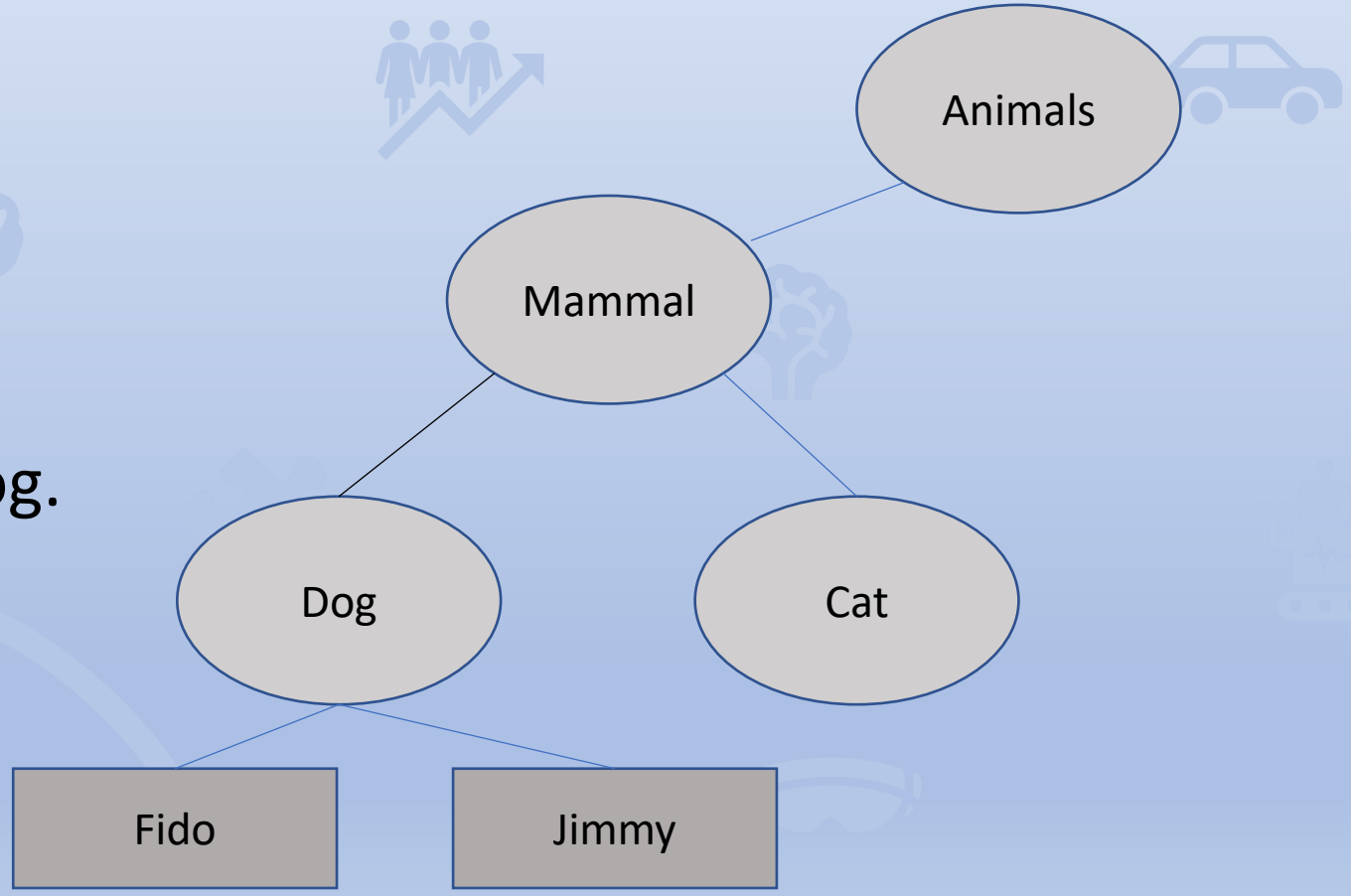
- Every dog has bitten every mail carrier.

Frame

A frame is a prototype of a concept

- Denoting the attributes of the concept
- The class of object concepts to which the concepts in question belongs.

- Fido is a dog
- Dog is a concept.
- Mammal is a concepts.
- Dog is a mammal.
- Fido is an instance of Dog.



```
Dog{
        is_a: mammal
        no_of_legs:4
        type of teeth: sharp
        has_tail:Yes
   }
```

Slots

- Slots denote attributes
- Attributes are typed
- Some values are defined in the frame definition.
- Some values are defined in the instances only.
- Instantiated slots define facts-may be used to answer queries.

What are there in a slot?

- Values
- Types
- Constraints over possible values
- Predicate-function
- Compare with object oriented system
- Slots can be structured