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$prop(Object, Attribute, Value)$ is the only relation needed:

object-attribute-value representation

Universality of *prop*

To represent “a is a parcel”

- *prop*(*a*, *is_a*, *parcel*), where *is_a* is a special attribute
- *prop*(*a*, *parcel*, *true*), where *parcel* is a Boolean attribute

Reification

- To represent $scheduled(cs422, 2, 1030, cc208)$. "section 2 of course $cs422$ is scheduled at 10:30 in room $cc208$."
- Let $b123$ name the booking:

$$prop(b123, course, cs422).$$

$$prop(b123, section, 2).$$

$$prop(b123, time, 1030).$$

$$prop(b123, room, cc208).$$

- We have reified the booking.
- Reify means: to make into an object.

Semantics Networks

When you only have one relation, *prop*, it can be omitted without loss of information.

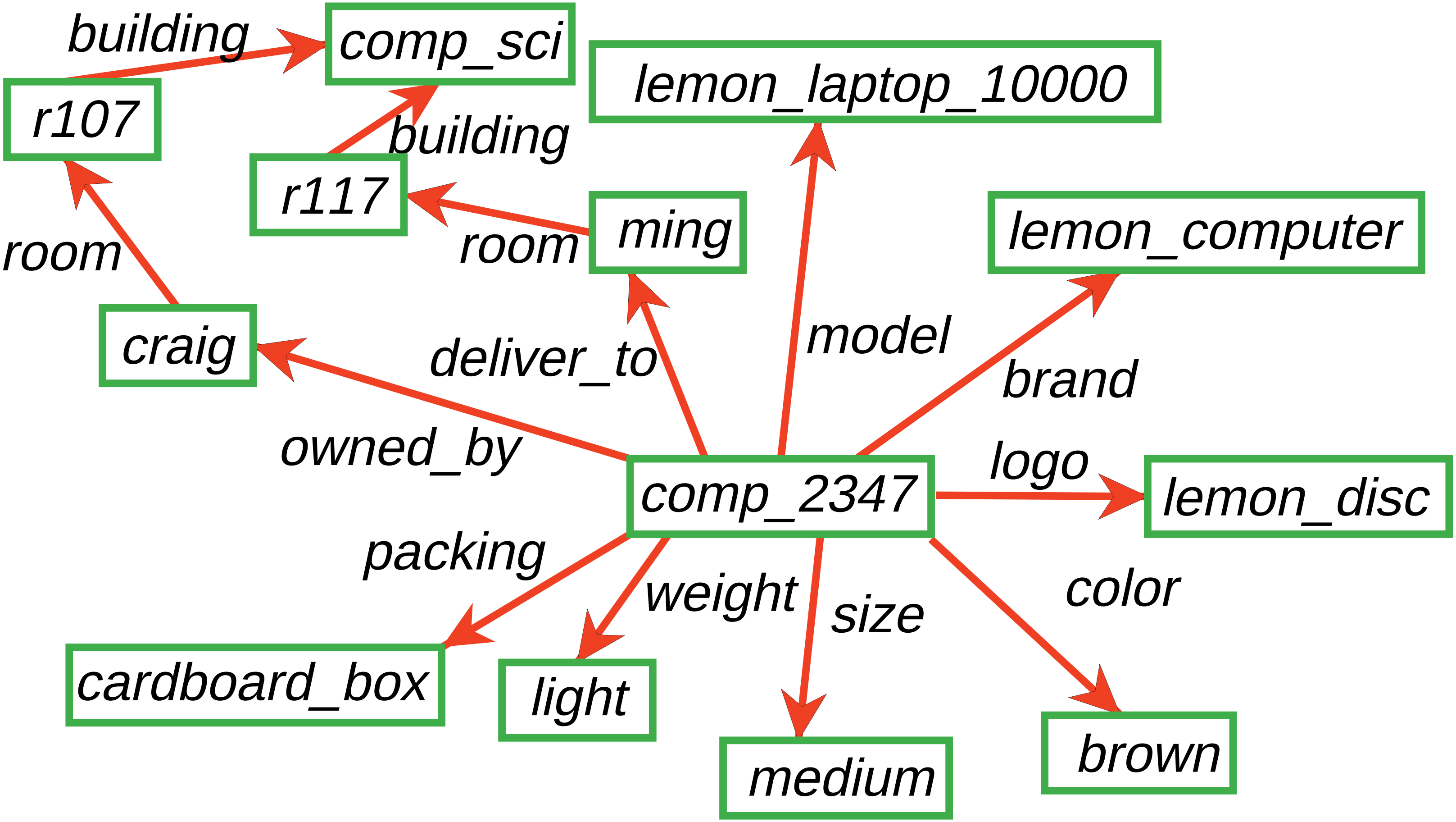
Write

$$prop(Obj, Att, Value)$$

as

$$\boxed{Obj} \xrightarrow{Att} \boxed{Val}$$

An Example Semantic Network



Equivalent Logic Program

$prop(comp\_2347, owned\_by, craig).$

$prop(comp\_2347, deliver\_to, ming).$

$prop(comp\_2347, model, lemon\_laptop\_10000).$

$prop(comp\_2347, brand, lemon\_computer).$

$prop(comp\_2347, logo, lemon\_disc).$

$prop(comp\_2347, color, brown).$

$prop(craig, room, r107).$

$prop(r107, building, comp\_sci).$

$\vdots$

Frames

The properties and values for a single object can be grouped together into a frame.

We can write this as a list of *attribute* $=$ *value* or *slot* $=$ *filler*.

$$[owned\_by = craig,$$

$$deliver\_to = ming,$$

$$model = lemon\_laptop\_10000,$$

$$brand = lemon\_computer,$$

$$logo = lemon\_disc,$$

$$color = brown,$$

$$\cdots]$$

Primitive versus Derived Relations

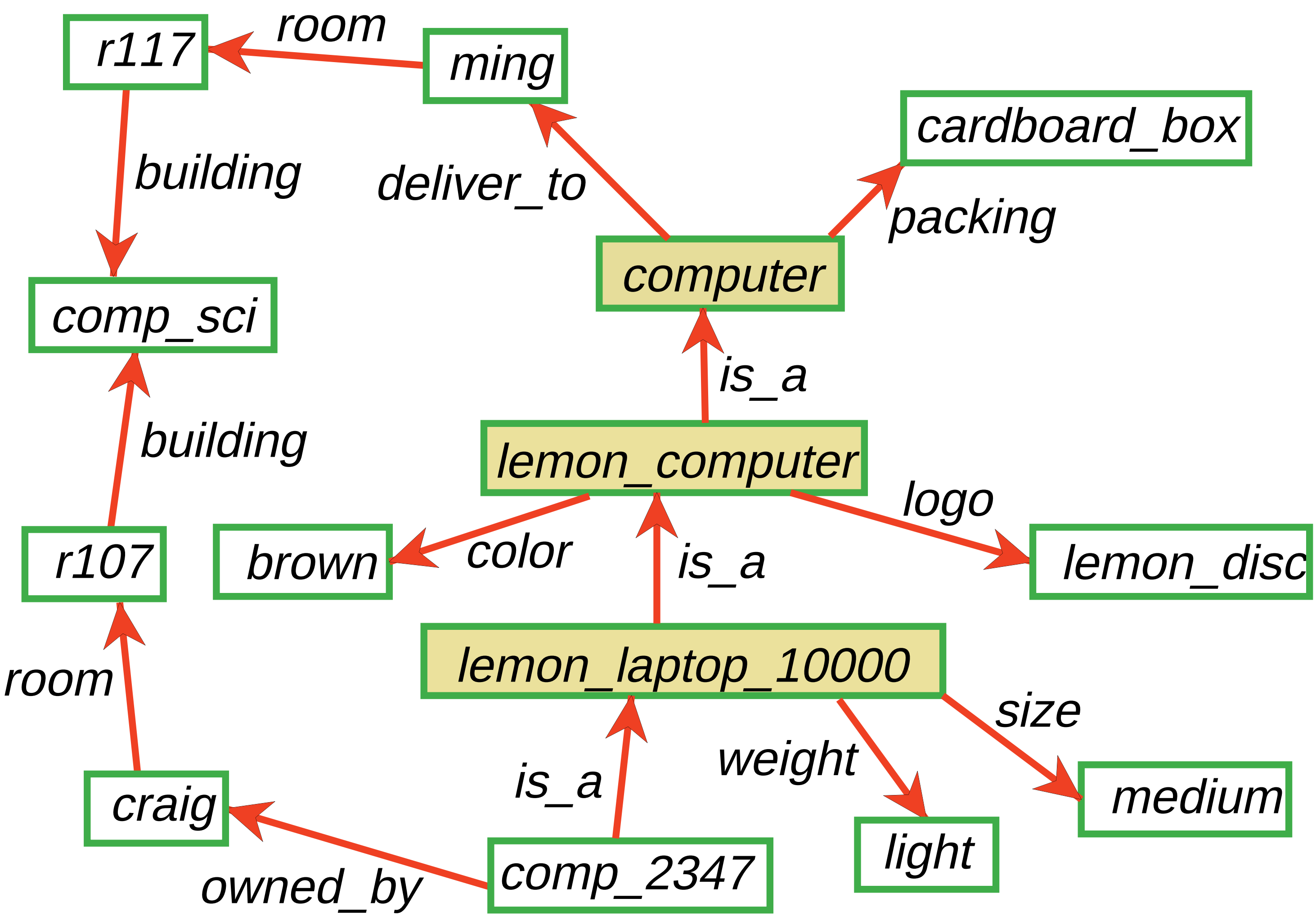
Primitive knowledge is that which is defined explicitly by facts.

Derived knowledge is knowledge defined by rules.

Example: All lemon laptops may have have $size = medium$. Associate this property with the class, not the individual.

Allow a special attribute *is_a* between an individual and a class or between two classes that allows for property inheritance.

A Structured Semantic Network



Logic of Property Inheritance

An arc $\xrightarrow{p} n$ from a class c means every individual in the class has value n of attribute p:

$$prop(Obj, p, n) \leftarrow$$
$$prop(Obj, is\_a, c).$$

Example:

$$prop(X, weight, light) \leftarrow$$
$$prop(X, is\_a, lemon\_laptop\_10000).$$
$$prop(X, is\_a, lemon\_computer) \leftarrow$$
$$prop(X, is\_a, lemon\_laptop\_10000).$$

Multiple Inheritance

- An individual is usually a member of more than one class. For example, the same persion may be a mother, a teacher, a football coach,….
- The individual can inherit the properties of all of the classes it is a member of: multiple inheritance.
- If there are default values, we can have a problem when an individual inherits conflicting defaults from the different classes: multiple inheritance problem.

Choosing Primitive and Derived Relations

- Associate an attribute value with the most general class with that attribute value.
- Don’t associate contingent properties of a class with the class. For example, if all of current computers just happen to be brown.
- Axiomatize in the causal direction. You want knowledge that is stable as the world changes.