

# Interactive Engineering

*Predictive Models*

*using*

*ORION Technology*

# Predicting Behavior

We build models to predict behavior of systems.

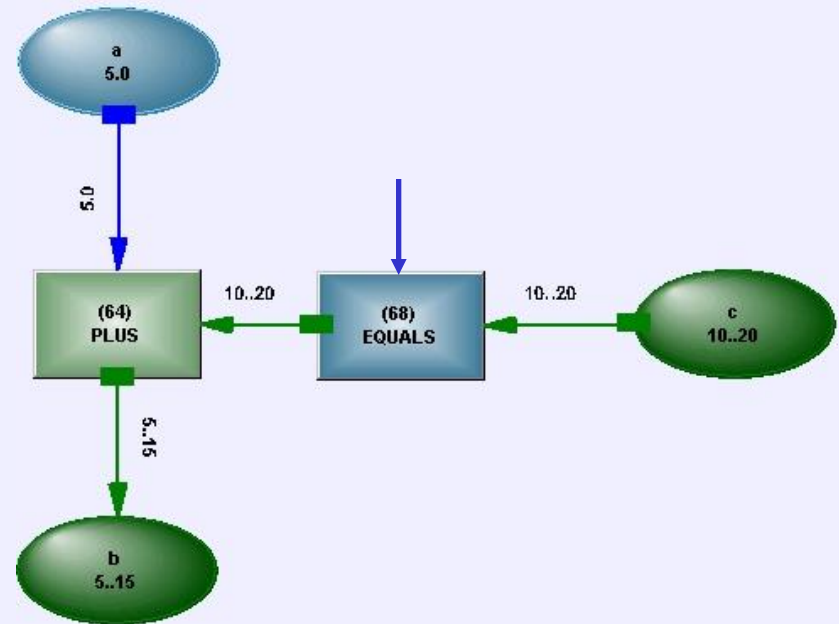
As the behavior grows more complex, we can only say how the parts of the model work, and we use the model to work out overall behavior.

The system we are attempting to model may be hidden from us, so the model has to continually guess at the internal structure, or the system may be dynamic, forcing the model to follow it.

# A Structure as a Model

If we use a structure as a model, the structure can store the states, and the operators in the structure can respond to changes in state on their connections.

The structure can handle analytic or experiential information, and the structure can change itself.



# *Some Elements*

- Shape Changing
- Distributed Control
- Experience / Uncertainty
- Hypothesizing

# Shape Changing

It can vary from the very simple

$X = \text{SUM}(\text{List})$

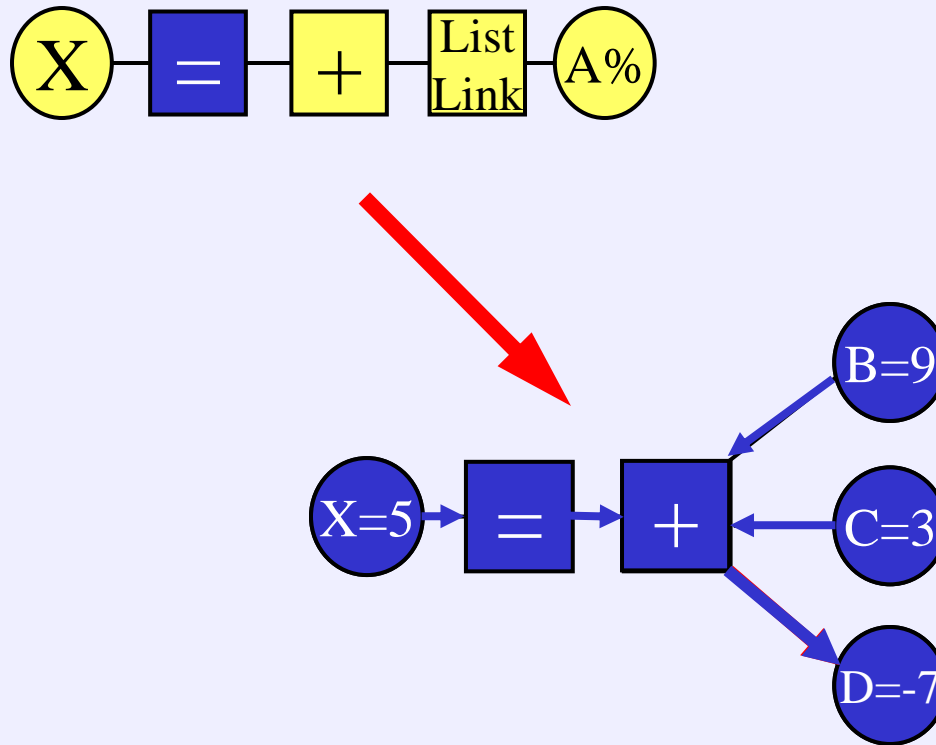
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to the very complex

The quake, with an estimated magnitude of 4.5, struck near Athens, around 0724 hrs.

The basis is that, while some operators in the network change numbers, others change connections, which changes behavior

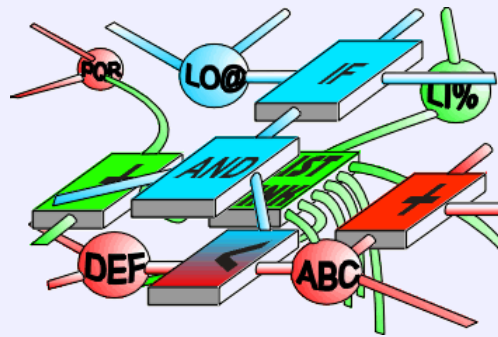
# Self Modification



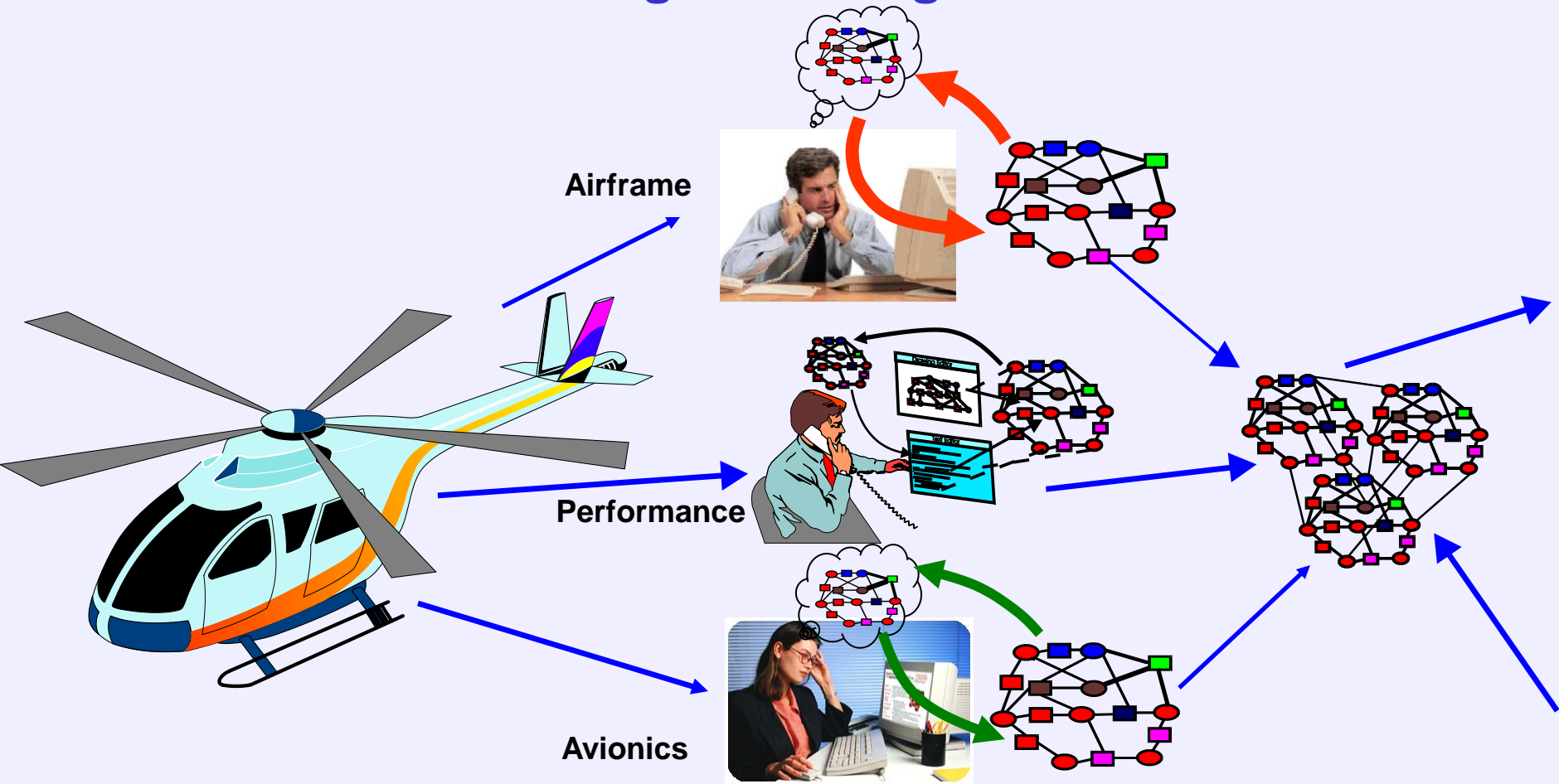
The structure changes itself, adding more structure and more states as it increases its complexity - essential if the structure is to contain all the states

# Combining Structures

It may seem simple, but the ability to combine knowledge structures is a very strong constraint on how the knowledge is structured.



# Combining Knowledge Domains

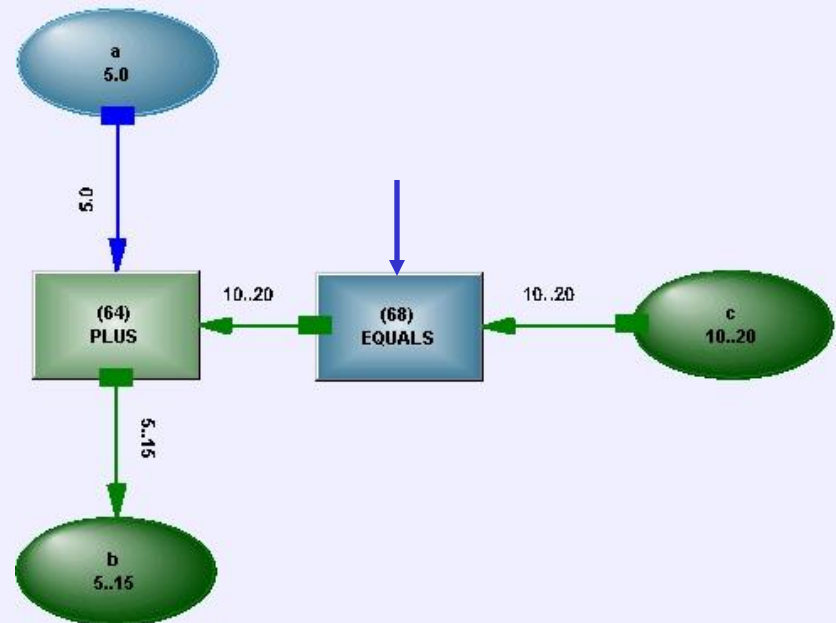


Assemble Pieces of Knowledge Into an Active Object  
Which Itself Can be Assembled...



# Distributed Control

Only by building model pieces out of elements that are themselves autonomous and embody their own control, can we assemble higher level structures that can also be combined in even higher level structures which interact depending on how they are connected.



# Hypothesizing

New structures need to be created, their consequences examined, and the construction undone:

Company A may merge with company B  
Company C is to divest itself of division D

This requires the addition of new connections and their later removal. Every change to the structure, no matter how slight, is recorded, allowing for full structural backtracking.

# Following a Hunch

The system can build on a hypothesis - it assumed Company A merged with Company B, resulting in structural alteration and reduced deviation between observed and expected, now the system attempts to build on its success by postulating other structure - a loan from a bank, say.

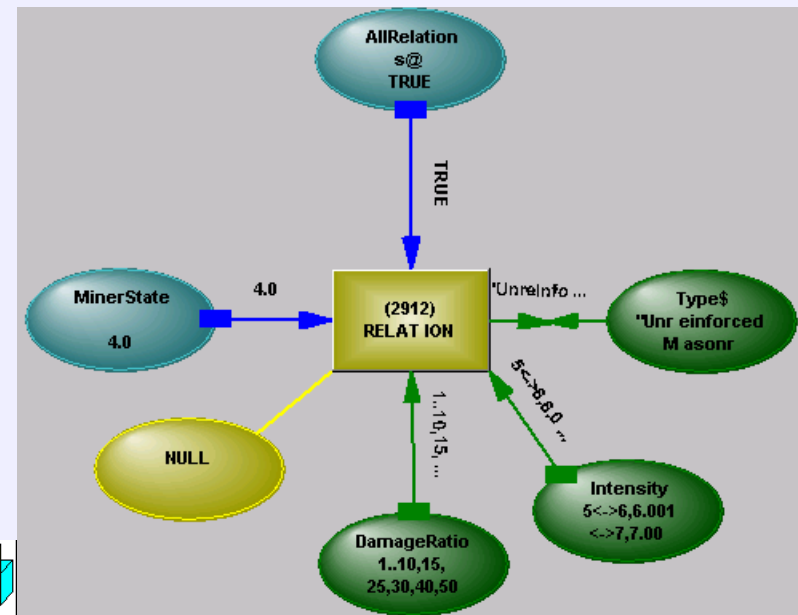
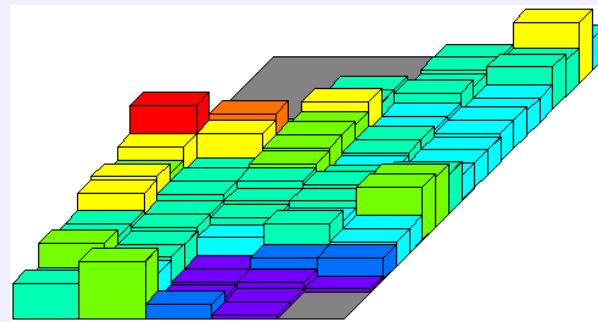
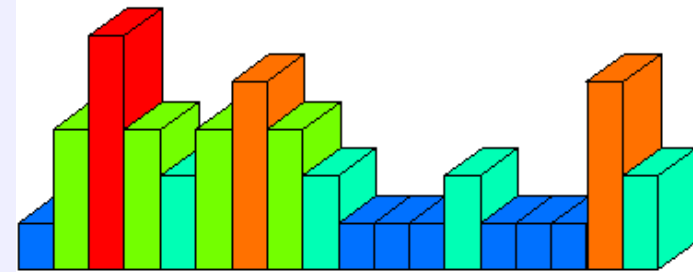
Relatively few scenarios can provide a rich source of possibilities as the system assembles them in unexpected ways in its efforts to match observed behavior.

When scenarios fail it, it falls back on recording the occurrence and storing it for later use stochastically.

# Experience / Uncertainty

In most cases, an analytic model will need to fall back on experiential knowledge or estimations of probability where analytic structure does not exist.

Special operators store a history of occurrence in distributions and correlations. These operators interact with analytic structure.



# Predictive Modeling

The elements combine to form an active, uncommitted structure capable of self-modification as it seeks to predict the behavior of a complex external system

