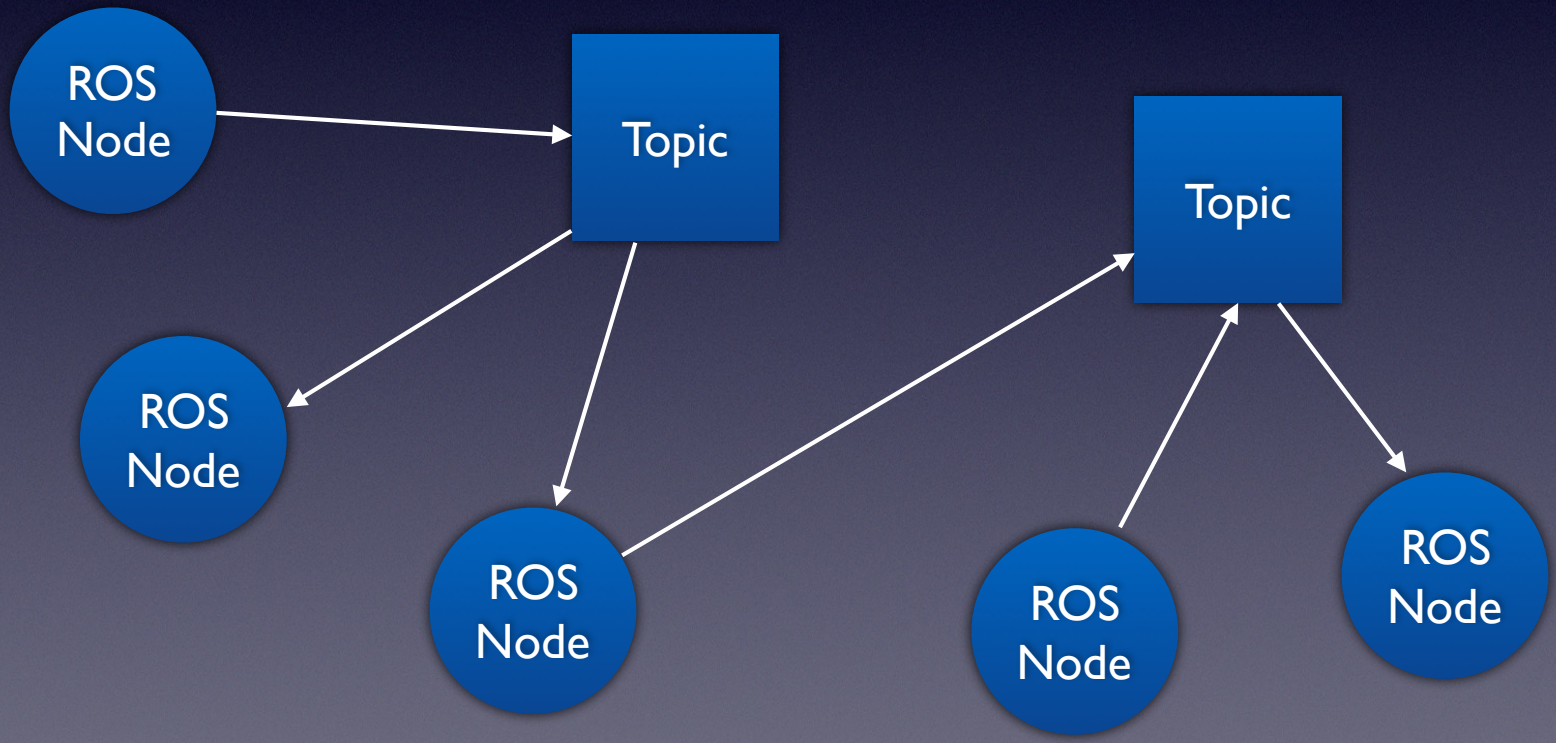
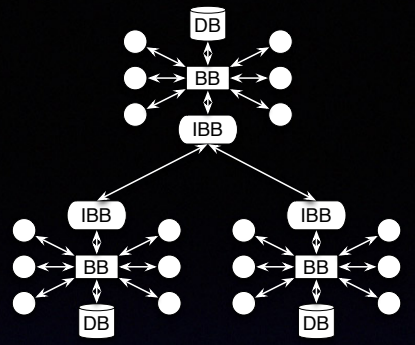
Software vs Cognitive Architectures

Robot Operating System (ROS)



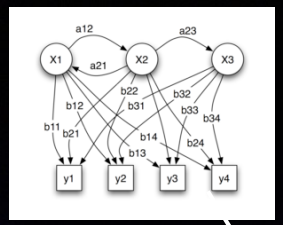
Blackboards



- Agents communicate by posting objects to blackboard
- Objects are timestamped and logged to a database
  - enables introspection and learning
- An agent subscribes to objects of specified types
- Agent is activated when object of the right type is posted

audio input

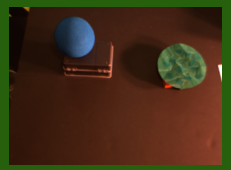
speech recognition



natural language processing

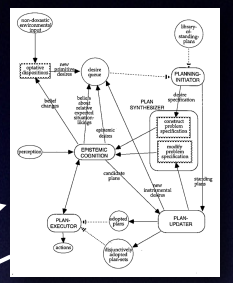
```
<postal-address> ::= <name-part> <street-address>
<name-part> ::= <personal-part> <last-name> <opt-jr>
<personal-part> ::= <first-name> | <initial> "."
<street-address> ::= <opt-apt-num> <house-num> <street>
<zip-part> ::= <town-name> "," <state-code> <ZIP-code>
<opt-jr-part> ::= "Sr." | "Jr." | <roman-numeral> | ""
```

stereo camera



“pick up the green ball”

pickup(B)

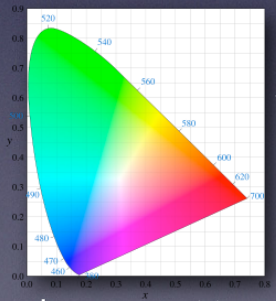


planner

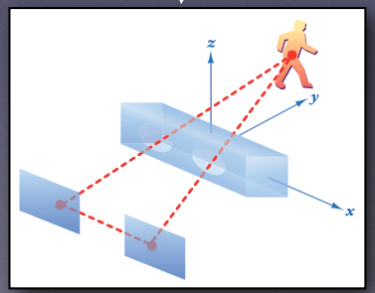
move(..)

contact

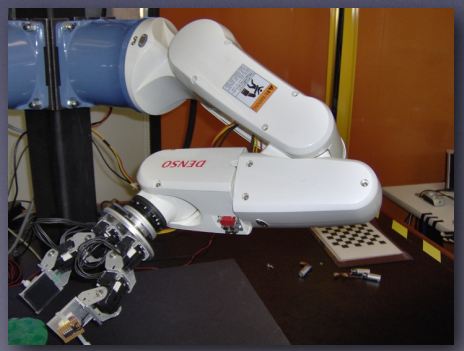
tactile sensors



colour recognition



depth analysis



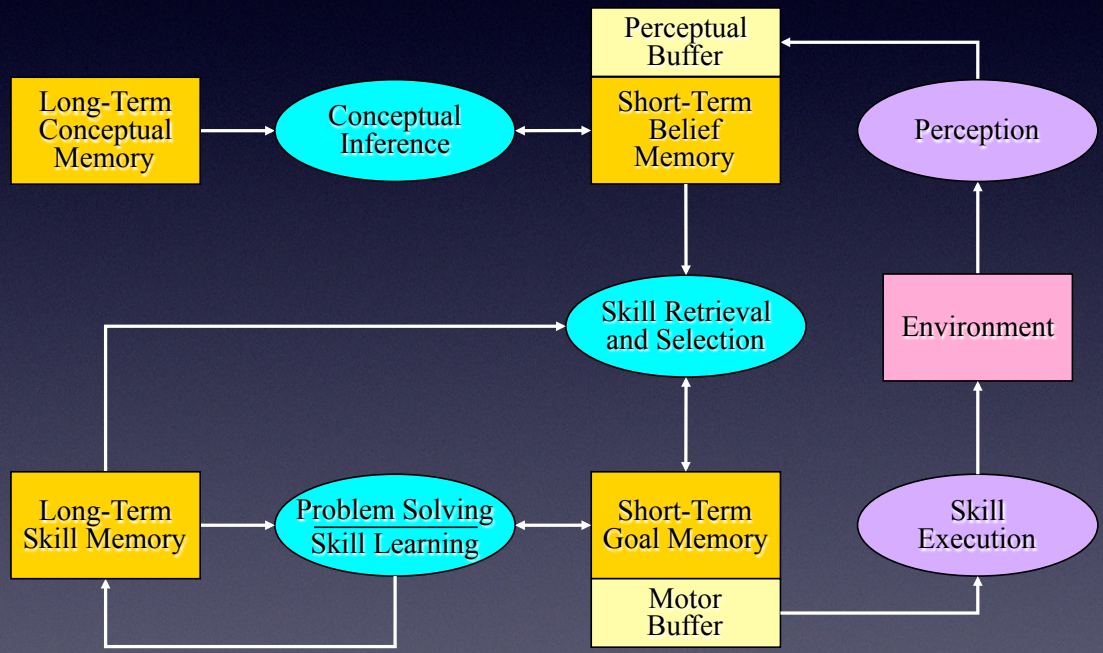
motor actions

Robot software architectures

- Most robot systems are ad hoc combinations of components
- Supported by software architectures (e.g. ROS)
- No principled way of combining components
- No principled way of extending system or components through learning

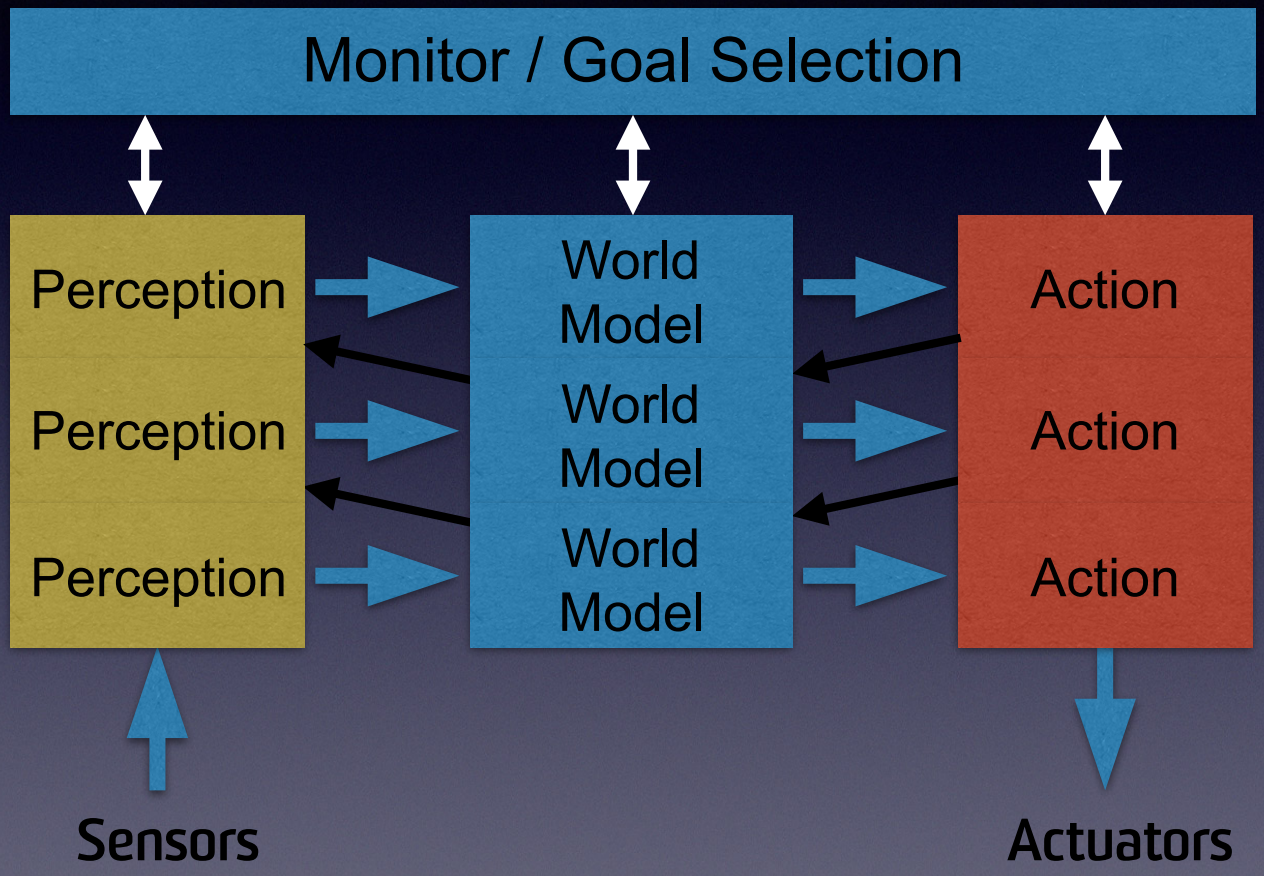
Cognitive Architectures for Robots

- How to integrate these specialised components?
- What is an appropriate architecture?



Icarus – Langley

Agent Architecture



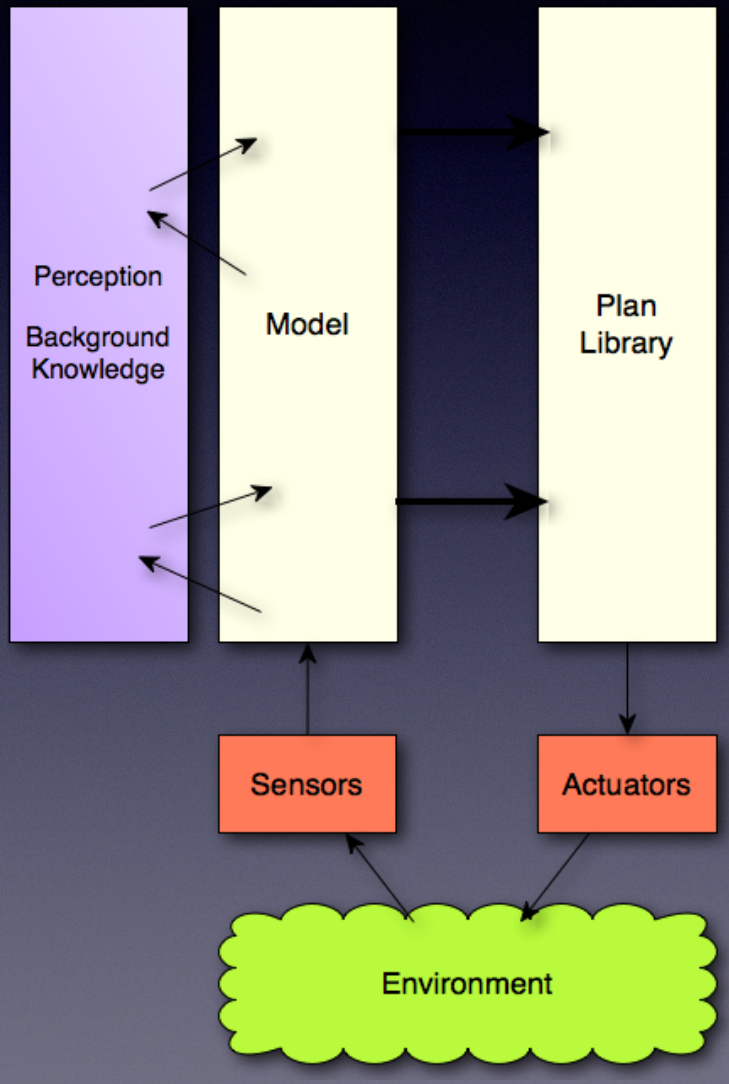
Albus - RCS

Nilsson - Triple Tower

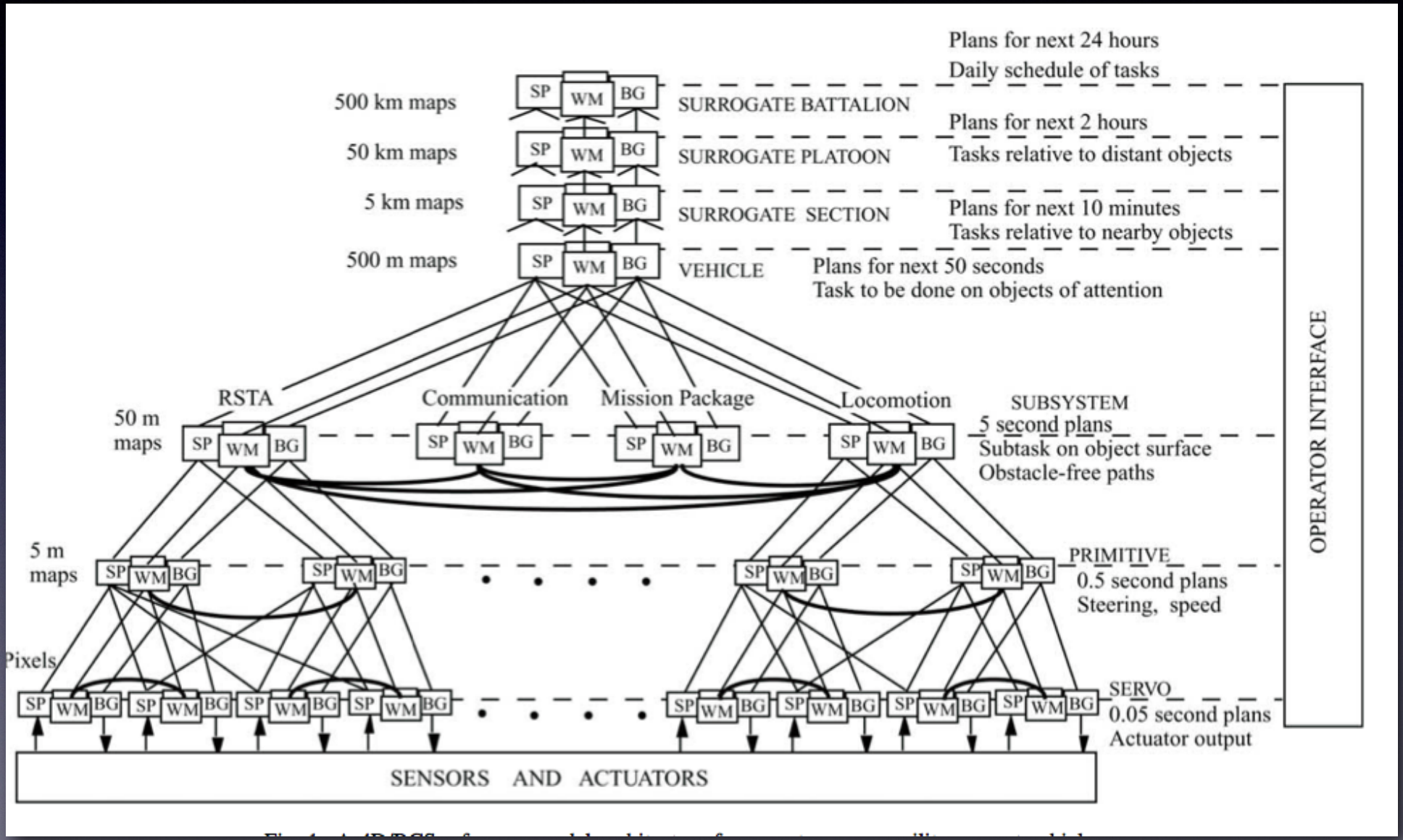
Scales in the Hierarchy

- General, deterministic, persistent, slow, human readable
- Specialised, stochastic, transient, fast, unreadable

Nilsson's Triple Tower



RCS (Albus)


Plans for next 24 hours
Daily schedule of tasks
500 km maps
SURROGATE BATTALION
Plans for next 2 hours
50 km maps
SURROGATE PLATOON
Tasks relative to distant objects
5 km maps
SURROGATE SECTION
Plans for next 10 minutes
Tasks relative to nearby objects
500 m maps
VEHICLE
Plans for next 50 seconds
Task to be done on objects of attention
RSTA
Communication
Mission Package
Locomotion
50 m maps
SUBSYSTEM
5 second plans
Subtask on object surface
Obstacle-free paths
5 m maps
PRIMITIVE
0.5 second plans
Steering, speed
Pixels
SERVO
0.05 second plans
Actuator output
SP
WM
BG
SENSORS AND ACTUATORS
OPERATOR INTERFACE