AI Programming Example: Age of Kings

CS 395 Game Design

Spring 2002

Updated class schedule

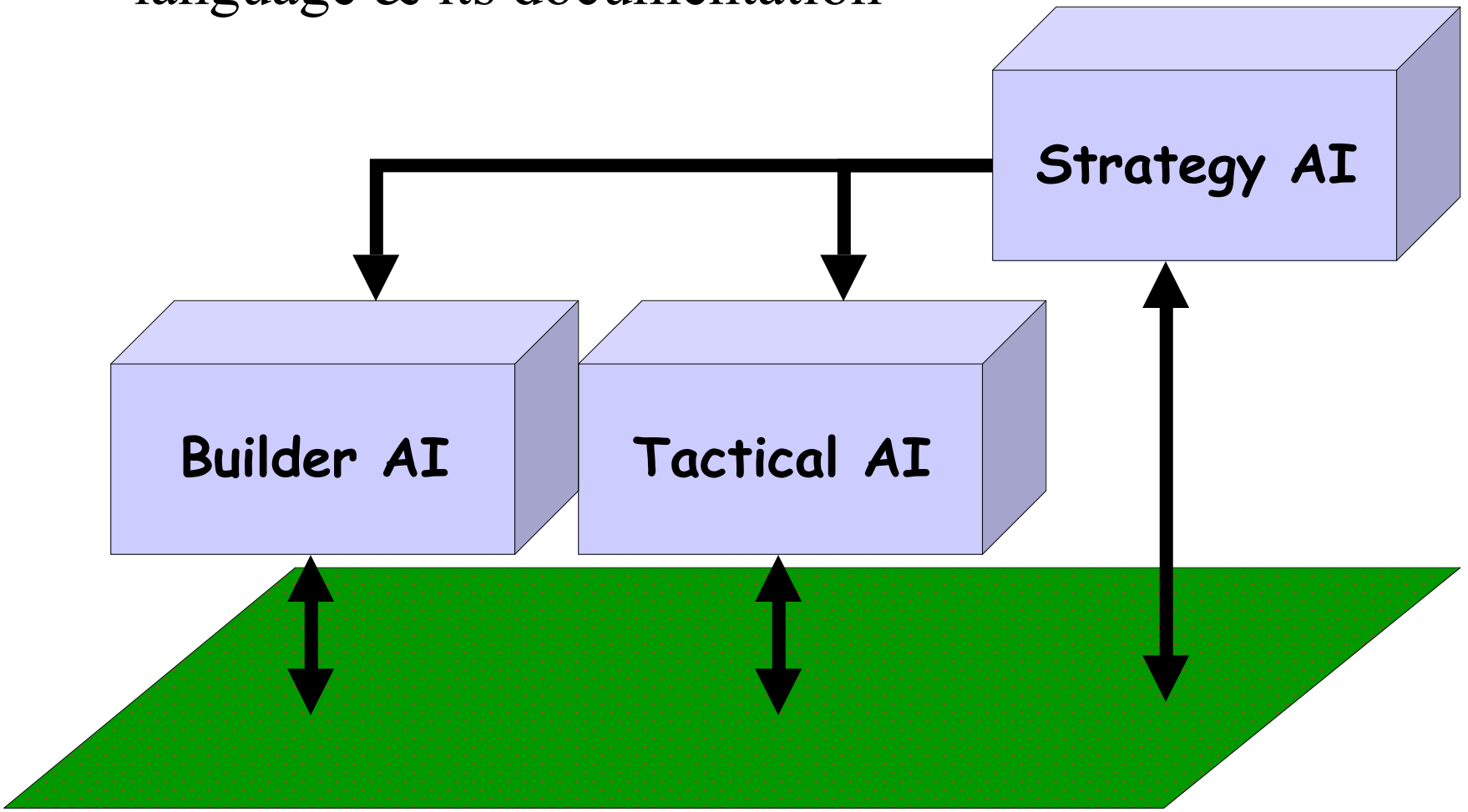
- Progress presentations will be May 23rd and May 28th
  - Someone from your team (and preferably all of you) must be present on your assigned presentation day.
- Two more homework assignments:
  - Today: Age of Kings AI programming
  - Creating an object in The Sims
- Rest of your effort should go to your term project

AI in Age of Kings

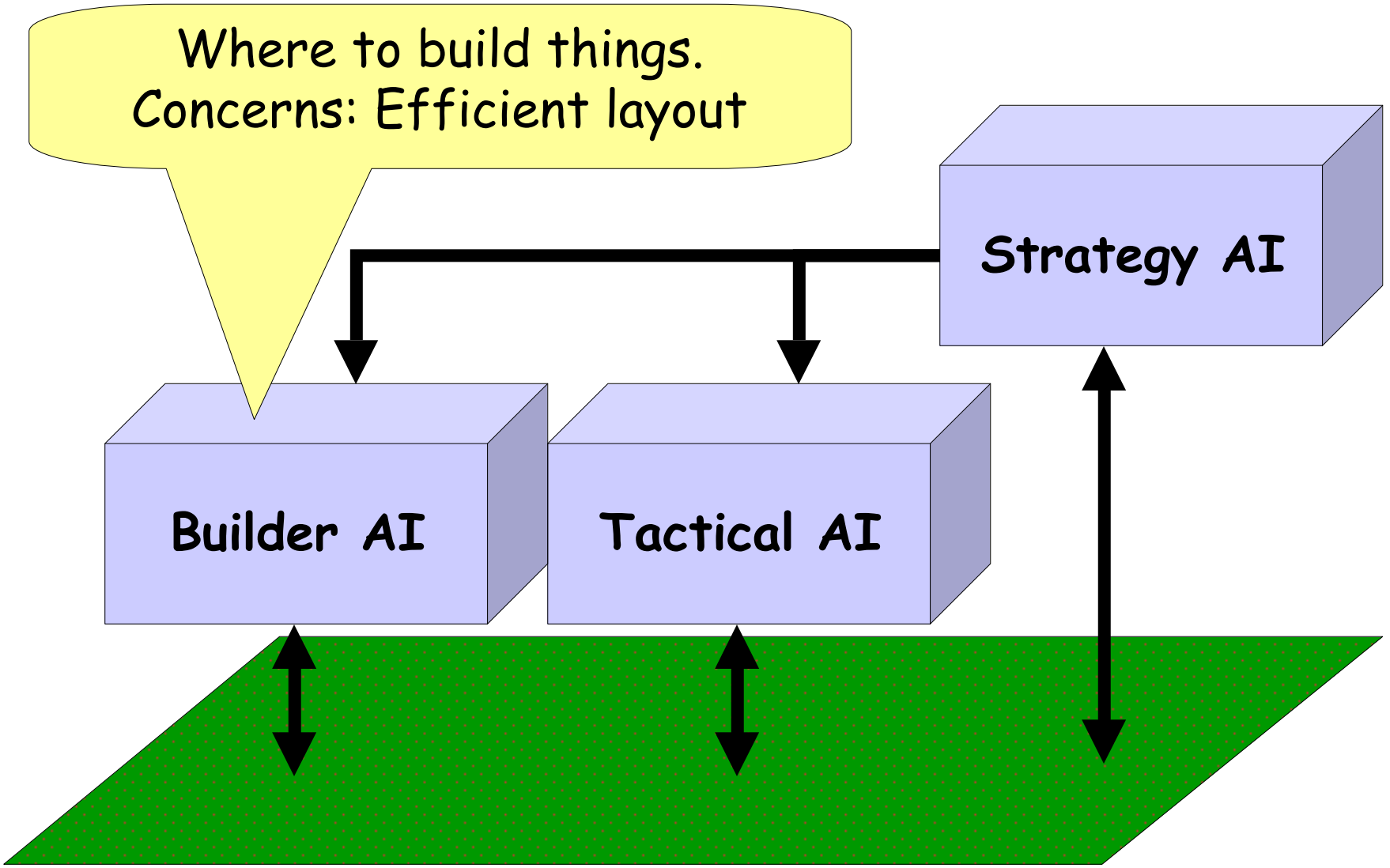
- Someone to outwit, outfight
- Crucial element in gameplay
  - Makes or breaks the single-player game
  - Enhances the multiplayer game
- AI for strategy games is an extremely hard problem
  - Requires reasoning about space, time, resources…
  - Workaround 1: Simplifications in game world
  - Workaround 2: Cheating

Rational reconstruction of AoK AI

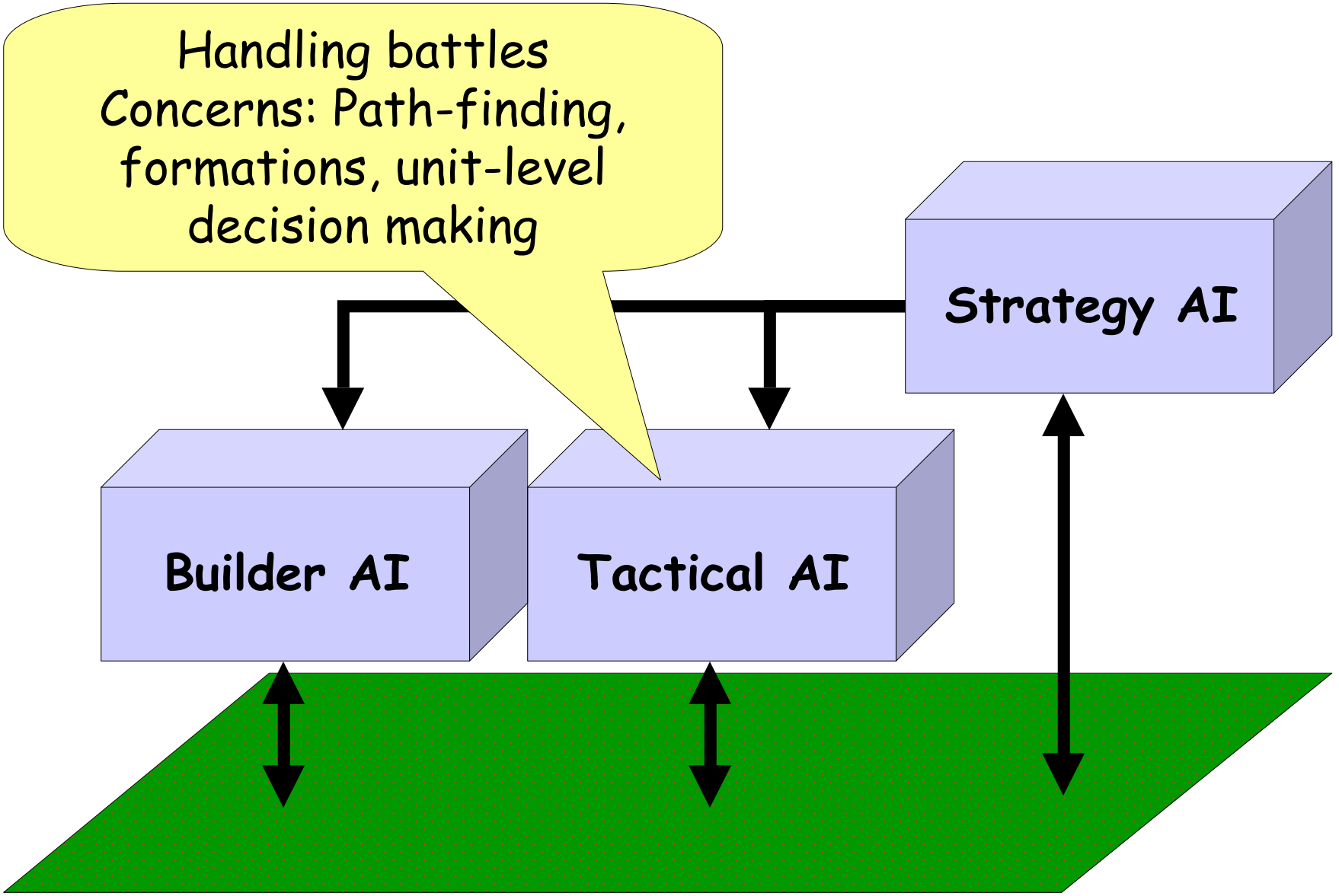
- No access to source, inferring from scripting language & its documentation



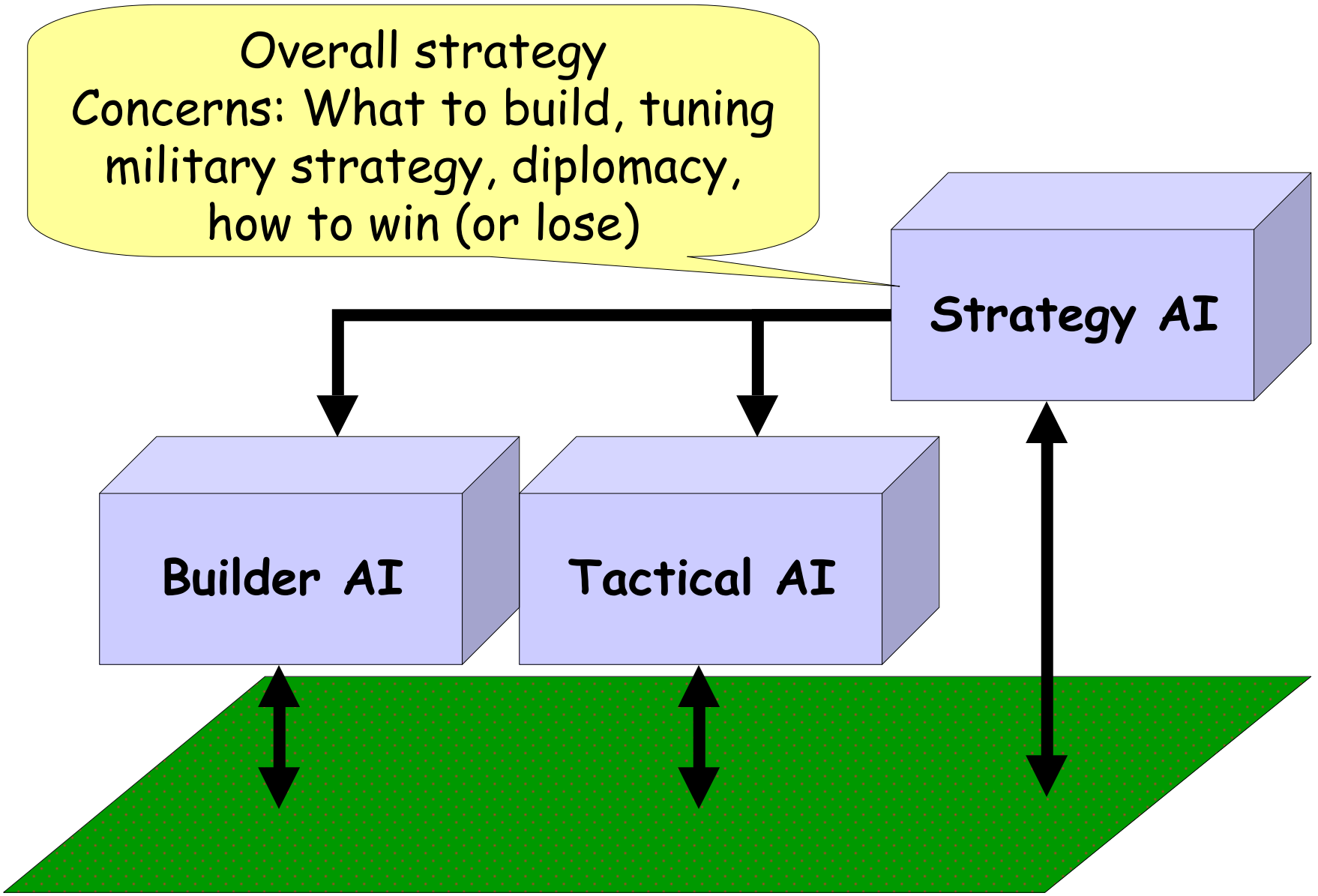
Builder AI


Where to build things.
Concerns: Efficient layout
Strategy AI
Builder AI
Tactical AI

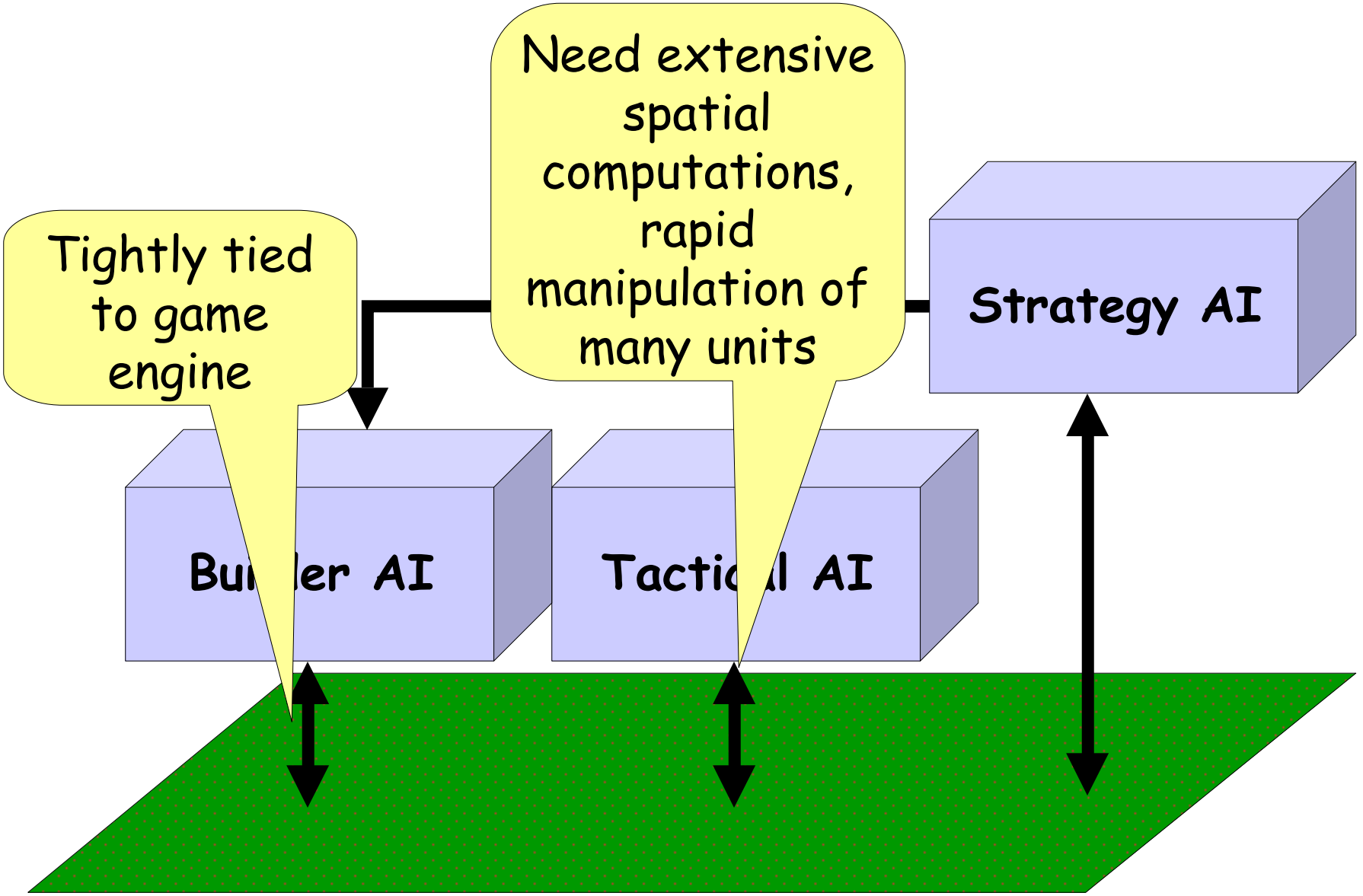
Tactical AI


Handling battles
Concerns: Path-finding, formations, unit-level decision making
Strategy AI
Builder AI
Tactical AI

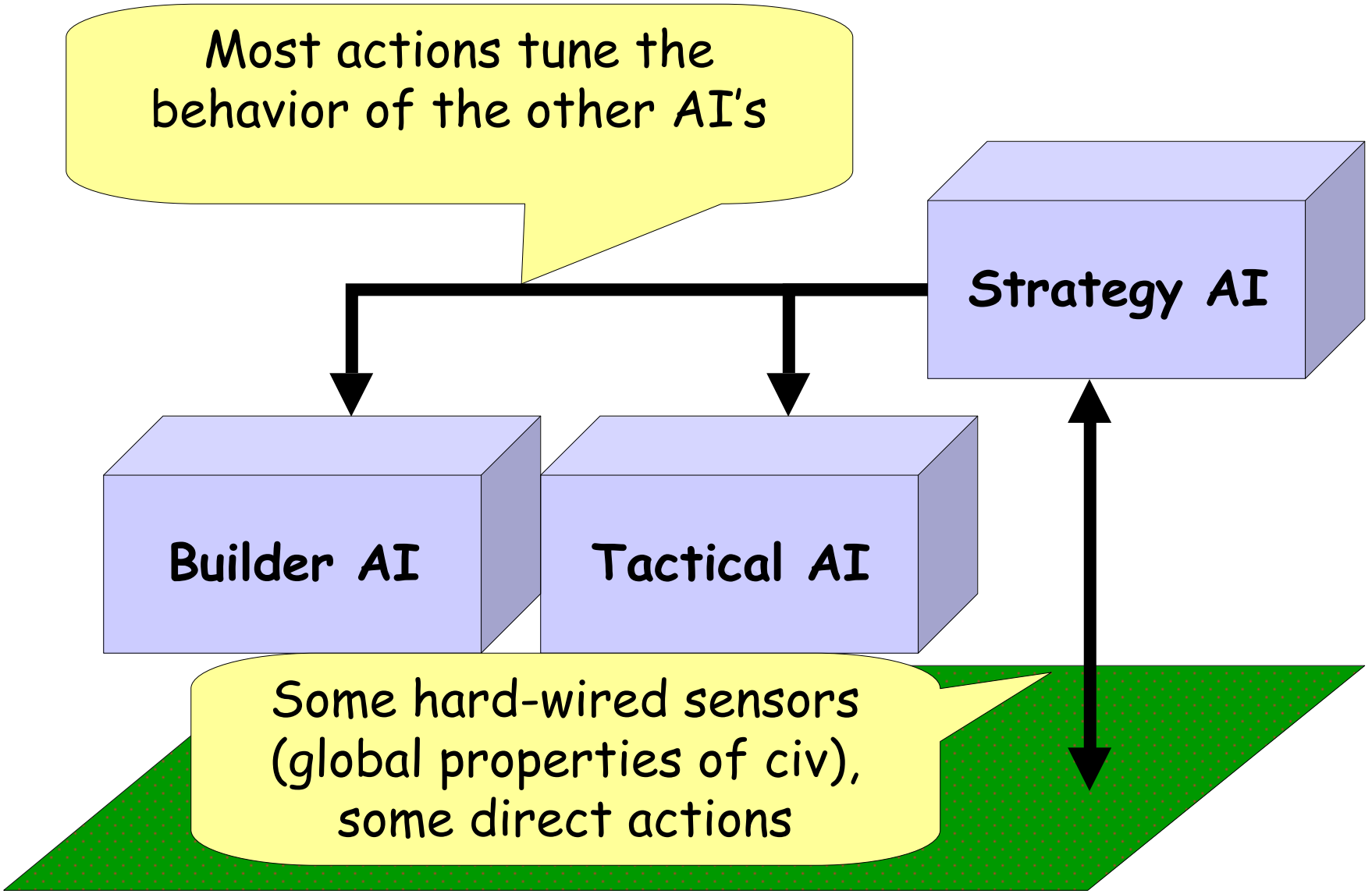
Strategy AI


Overall strategy
Concerns: What to build, tuning military strategy, diplomacy, how to win (or lose)
Strategy AI
Builder AI
Tactical AI

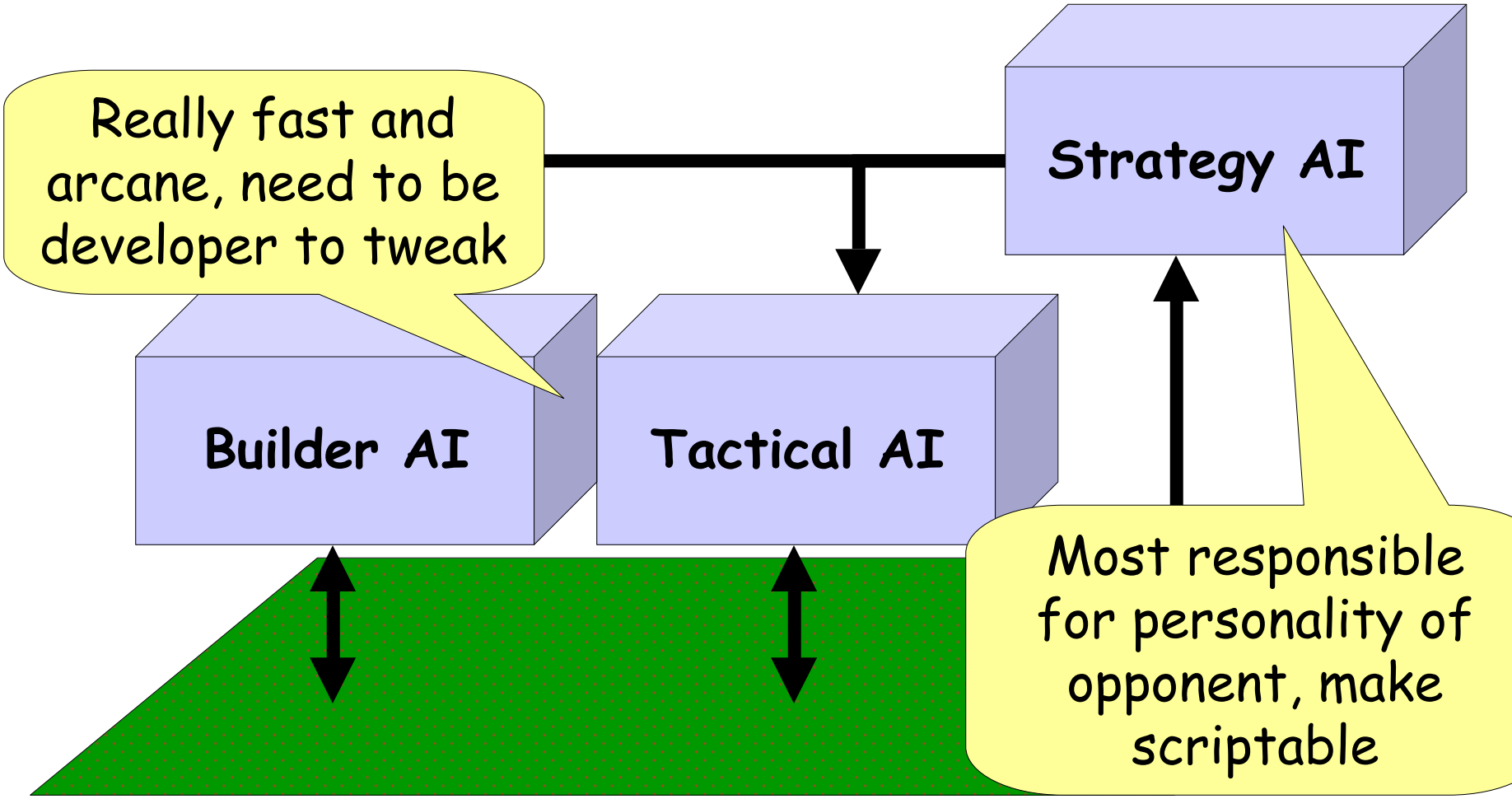
Sensors/effectors for hardwired AI's



Sensors/Effectors for strategy AI



Gameplay tuning



Scripting languages for AI's

- Range from homebrew to Python/Perl to Scheme
- Age of Kings' scripting language is based on *production rule systems*

Production rules motivation

- Designed to model human problem solving
  - Developed by Allen Newell and Herb Simon
- Each piece of knowledge can be added independently
  - Models human ability to learn incrementally
- Often used in building expert systems
- Sometimes used in psychological modeling
  - Examples: Act-R, SOAR, 4CAPS, …

Simplifications in Age of Kings rules

- No symbolic assertions or pattern variables
  - Instead, use tests from pre-defined vocabulary of procedures
  - Significance: Can't easily select from multiple items satisfying a criterion, can't extend the representation language
- No assertions of symbolic data in actions
  - Instead, use vocabulary of executable procedures for actions
  - Significance: Marginal reasoning abilities, due to lack of chaining.
- No conflict resolution (e.g., picking one rule to run)
  - Instead, run all that match every cycle (several cycles/second)
  - Significance: Good idea given purpose is control of a system with multiple parts all operating (conceptually) at once)

```
#load-if-defined DIFFICULTY-MODERATE

;attack timer - once in feudal, or if rushing, launch attacks
every 5 minutes

        (defrule

                (or (current-age >= castle-age)

                    (goal rush-control RUSHING))

        =>

                (enable-timer t-attackgroup 1)

                (disable-self))


        (defrule

                (timer-triggered t-attackgroup)

        =>

                (disable-timer t-attackgroup)

                (enable-timer t-attackgroup 300))


#end-if
```

Time to spelunk…