Multi-Tier AI and Behavior Tree for RTS Games

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Introduction: Real Time Strategy

- Starcraft II
- C&C: Tiberium Wars
- Battle for Middle Earth II
- Company of Heroes
Problem: AI Complexity

RTS games require complex behaviors

- Attack target?
  - Which target?
  - How to attack?
- Move to location?
  - Where?
  - How?
Problem: AI Complexity

• Each unit has an unique response
  – Local environment
  – Overall strategy

• RTS games have lots of units
  – Starcraft II, 200 per side x 8 sides = 1600 units
Multi-Tier AI

Figure 6.23 An example of multi-tier AI

http://xkcd.com/
Multi-Tier AI

- Reduces the complexity of each layer
- Increases the ease of design
Behavior Tree

- FSM with implicit transitions
  - Reduces design complexity
  - Increases run-time complexity
    - Data-oriented behavior tree
    - Smart design
  - Basic Nodes
    - Selector - executes children until success
    - Sequence - executes children until fail
    - Condition - returns result of a condition
    - Action - executes an action
Example Behavior Tree: Unit Layer
Example Behavior Tree: Strategy Layer
Demo: Metal Command

vs.
Problem: Communication

• Lots of game data
  - Positions
  - Unit Counts
  - Building Counts
  - Resources

• How to get the data to the behavior tree?
  - Avoid Dependency
Blackboard

- Hash tables
- Data abstraction

<table>
<thead>
<tr>
<th>Faction</th>
<th>FactionColor</th>
<th>UnitCount</th>
<th>BaseCount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Faction0</td>
<td>Blue</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>Faction1</td>
<td>Red</td>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td>Faction2</td>
<td>Yellow</td>
<td>4</td>
<td>2</td>
</tr>
</tbody>
</table>
More Example Nodes

- Condition: Stronger Than Enemy
- Condition: Weaker Than Enemy
- Condition: Has X Number of Units
- Condition: Base Under Attack

- Action: Target Weakest Enemy Base
- Action: Target Strongest Enemy Base
- Action: Reinforce Location
Demo: Metal Command

Action: Target Weakest Enemy Base

VS.

Action: Target Strongest Enemy Base
End

Any questions?

Source:
Artificial Intelligence for Games, 2nd Ed
Ian Millington and John Funge