The Predators‘ Guide
A parallelized prey-predator-simulation
Structure

- Game concept
- Birth
- Death mechanics
- Animal behaviour
- World composition
- Implementation
- Parallelization
- Speedup
Game concept

- 2-dimensional world
- plants, herbivore and carnivore
- carnivore look for herbivore and eat them
- herbivore look for plants and eat them
Birth

- Plants spawn randomly
- Animals bear children, independent from any other animals nearby
- Herbivore bear a child every two rounds (50% rate)
- Carnivore bear a child every five rounds (20% rate)
Death mechanics

- Old age
- Natural death rate (e.g. accidents)
- Animals lose two energy points each round
- Fights decrease the energy level even further
- An energy level of zero means death
- Eating a plant or herbivore restores the energy level to the maximum value ten
Animal behaviour

- Animals look for food in the adjacent fields
- If they find food, they will move towards it
- If a carnivore encounters a herbivore, they will fight
- Their strength equals their energy level (+5 bonus for predators)
- Strong herbivores can defeat weak carnivores
- The other animals will move randomly
World composition

- Rectangular world, divided into segments of the same size
- Each segment contains square fields
- On a field there can be either a herbivore or a carnivore
- Additionally, there can grow a plant
- The size and number of segments is determined by the number of processors available

<table>
<thead>
<tr>
<th>UP_LEFT</th>
<th>UP</th>
<th>UP_RIGHT</th>
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<tbody>
<tr>
<td>LEFT</td>
<td>processor's segment</td>
<td>RIGHT</td>
</tr>
<tr>
<td>DOWN_LEFT</td>
<td>DOWN</td>
<td>DOWN_RIGHT</td>
</tr>
</tbody>
</table>
Results
Implementation

- fields store the main part of the information: coordinates, populations and plants residing on it and their age and energy level

- fully-customizable configuration
Parallelization

- segmentation on startup by prime factorization
- a processor stores all of its segments fields as well as all directly adjacent fields, so-called border fields
- when a border or outer field changes, the appropriate processes are notified
Speedup with 1 node
Speedup with 4 nodes

![Graph showing speedup with 4 nodes]
Thank you for your attention.