A VIRTUAL ENVIRONMENT FOR REASONING WITH SENSORIAL INFORMATION

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OUTLINE

Introduction

Objectives

Design

Development

Experimentation

Conclusions

Demo

INTRODUCTION

What is Artificial Intelligence?

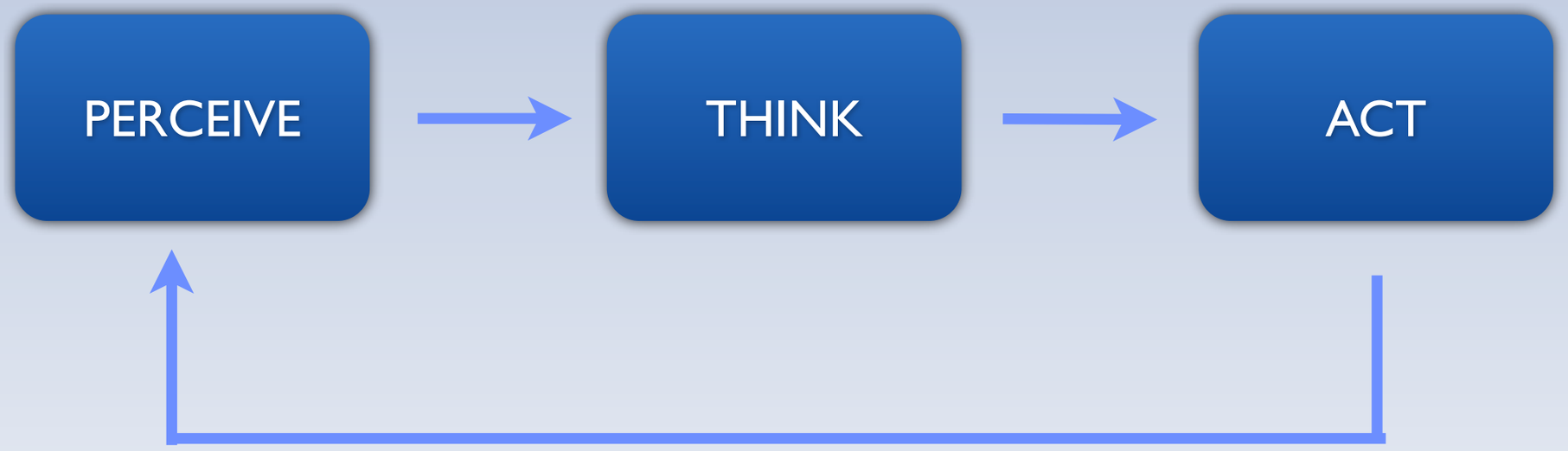
- Creation and simulation of intelligent behaviour
- Ability of acting and thinking rationally

Game AI

- Subfield of AI
- Games used as research AI field
- Important in game development industry

Human-like behaviour

Decision making process:



OBJECTIVES

Game implementation

- Based on perceptions
- Incomplete information
- Uncertainty

OBJECTIVES

Game implementation

- Based on perceptions
- Incomplete information
- Uncertainty

AI player

- Decision making
- Pathfinding
- Adaptation

DESIGN

Game's characteristics

- Multi-agent
- Partially observable
- Stochastic
- Sequential
- Dynamic

DESIGN

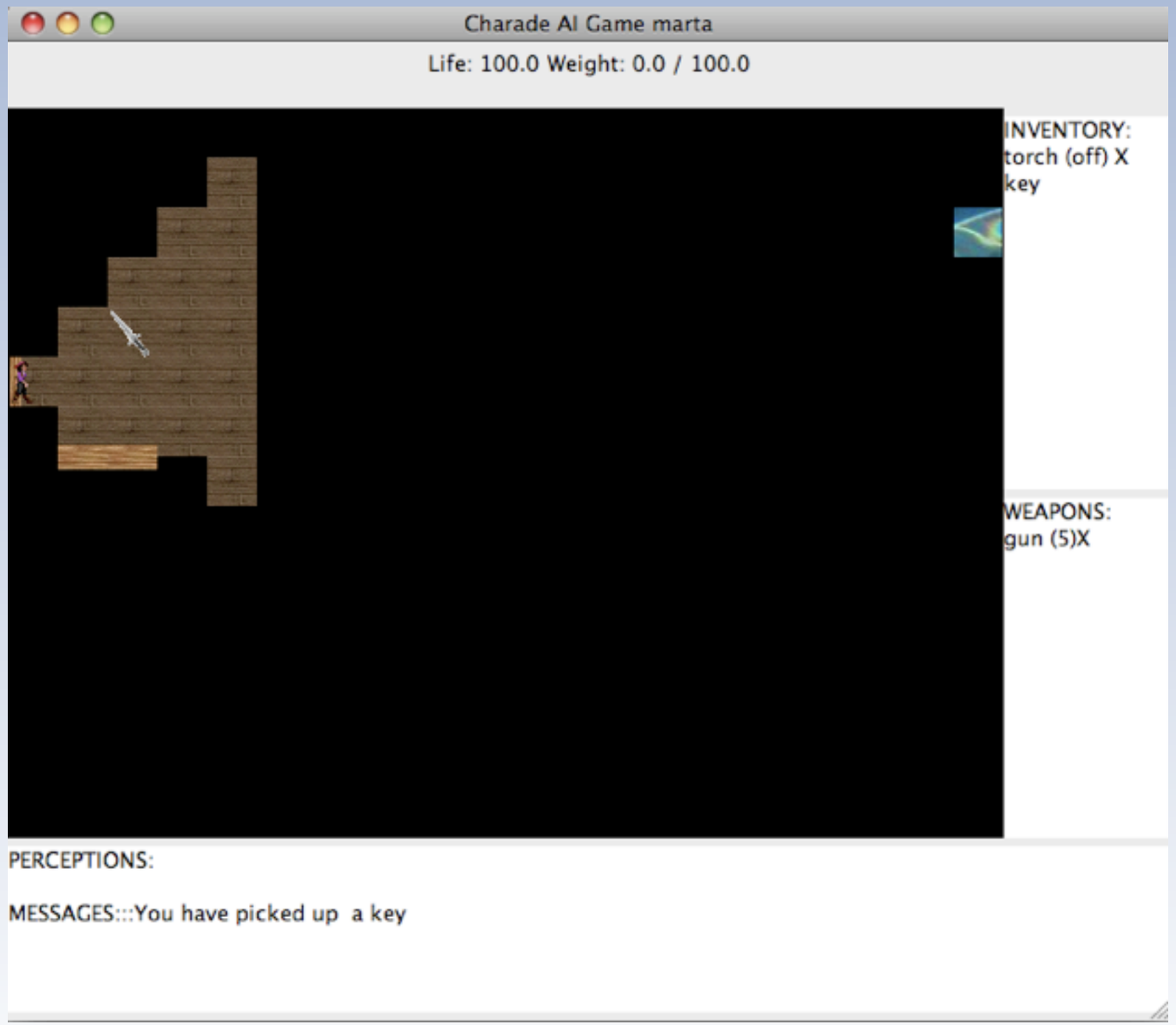
Player's characteristics

- Reactive
- Context specific
- Flexible
- Realistic
- Easy to develop

Description of the game

- Real-time simulation
  - Sending actions
  - Executing actions
- Goal: reach a target location
- Players can interact with:
  - other players (attacking, shouting)
  - environment (opening doors, picking up items, etc)

Description of the game



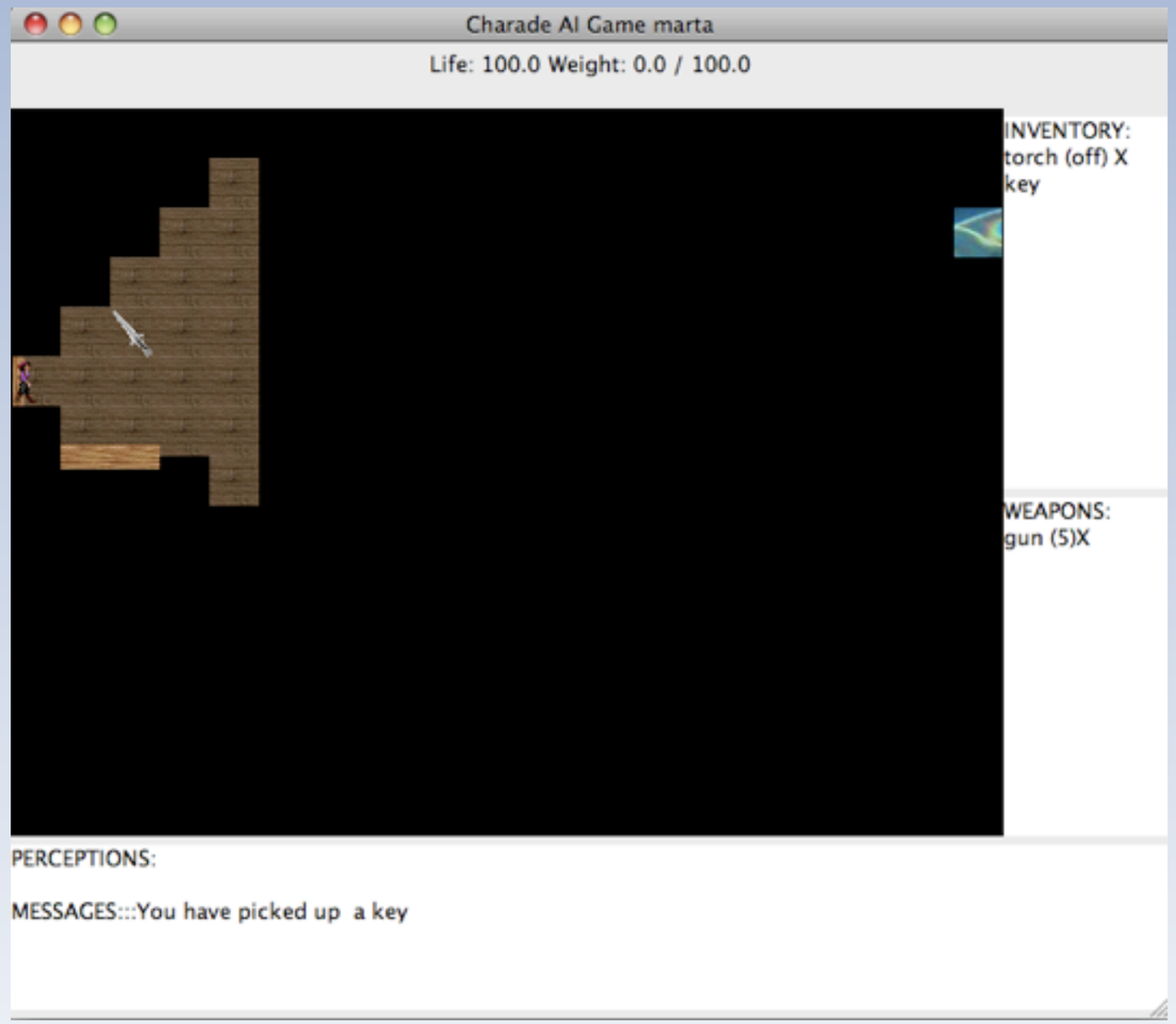
Design

Description of the game

Elements:

- Players
- Cells
- Walls & doors
- Weapons
- Objects
- Obstacles

Description of the game



Actions:

- Move
- Attack
- Pick up & leave objects
- Use objects
- Open / close doors
- Reload weapons
- Turn

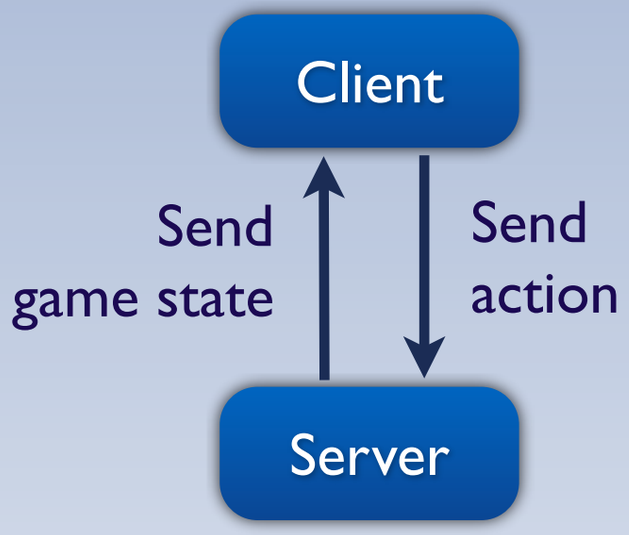
Design

System's architecture

Client / Server:

- Independent
- Bidirectional

- Client: Java
- Server: Erlang



System's architecture

Server:

- Executes main functionalities
- Splitted into:
  - Game server
  - Login server
  - Proxy servers

System's architecture

Thin client:

- Non-duplicated information
- Consistent information
- Improvement in performance
- Security

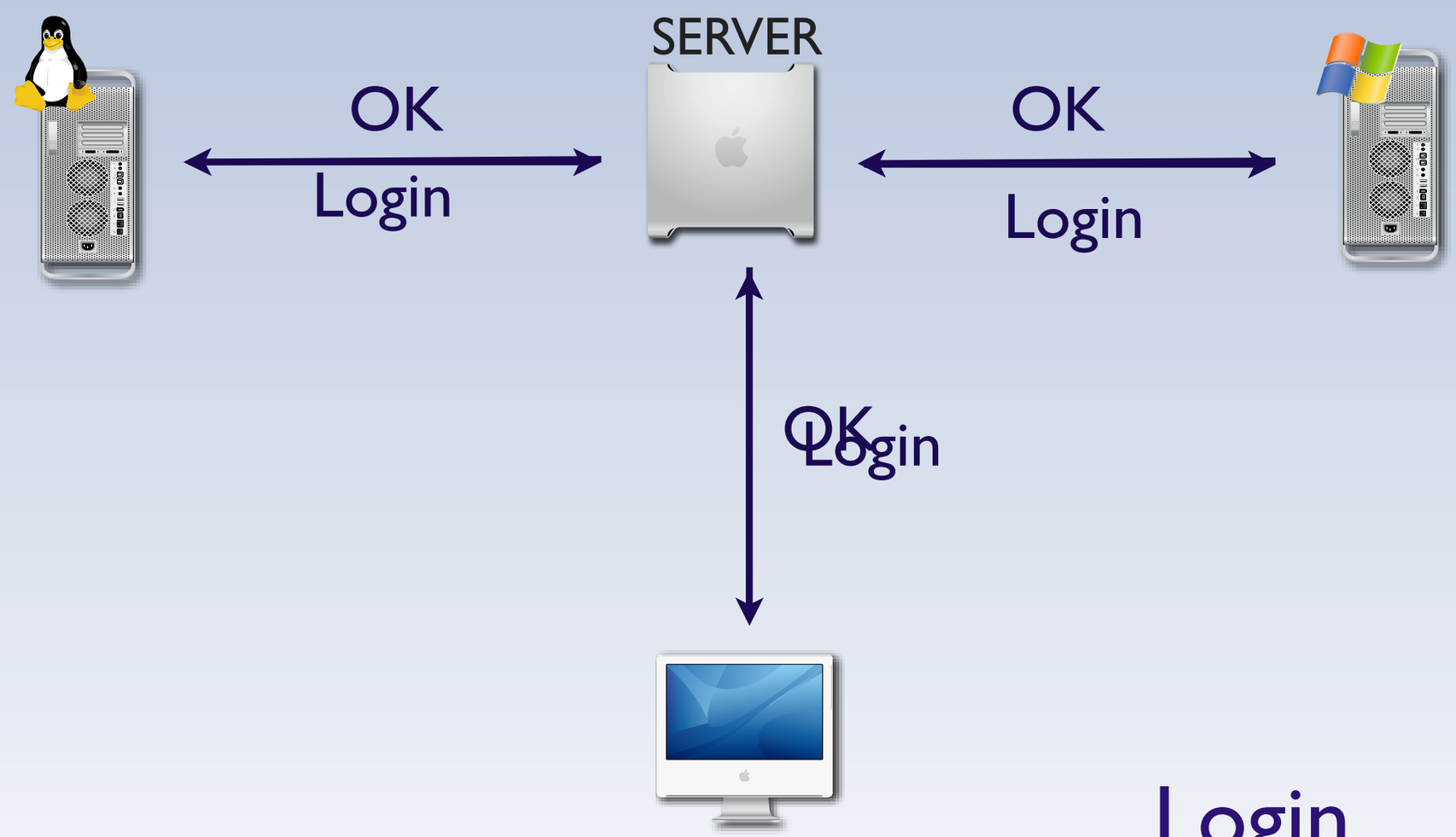
System's functionality

Game configuration:

- Load configuration
- Initialize components

Development

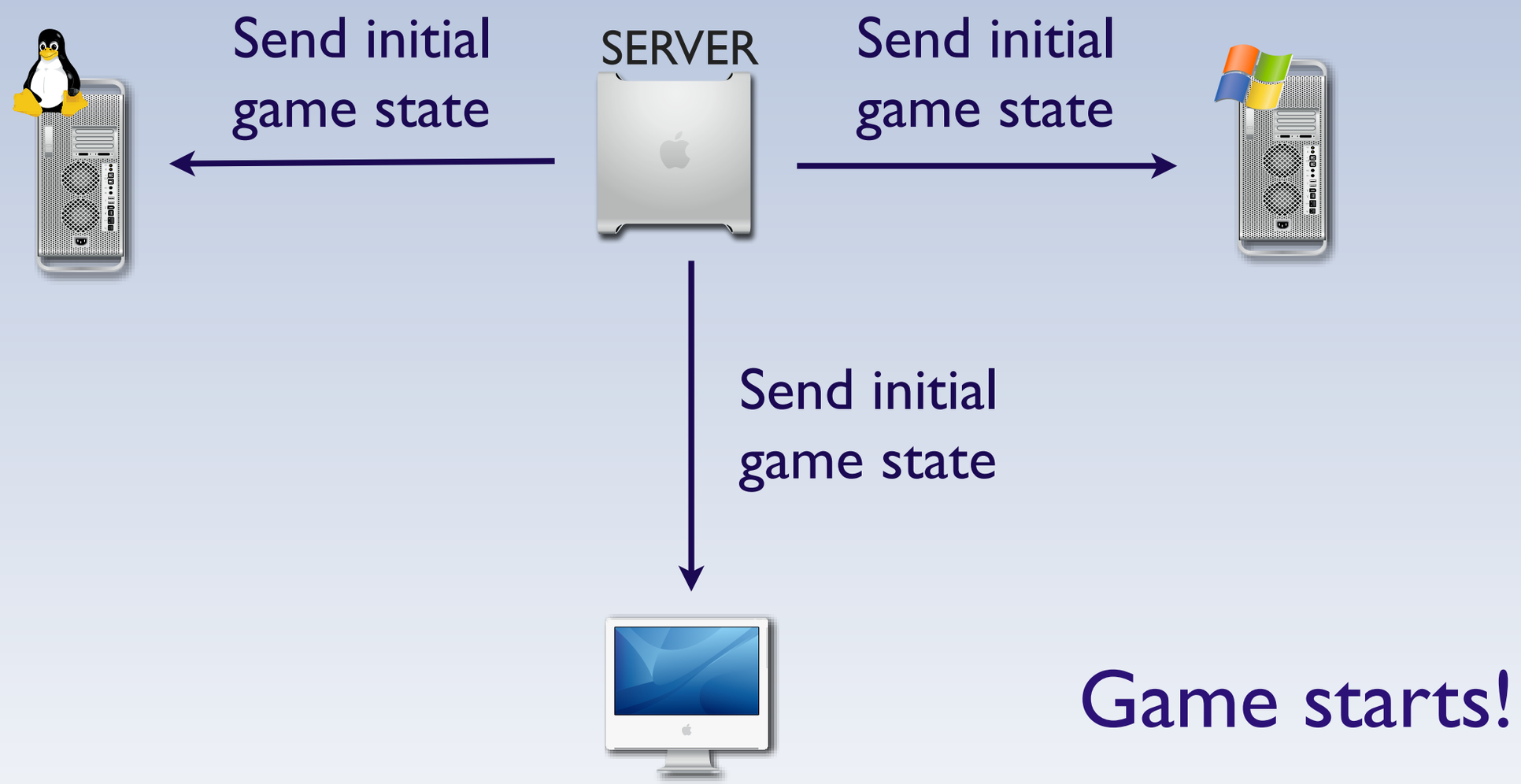
System's functionality



Login

Development

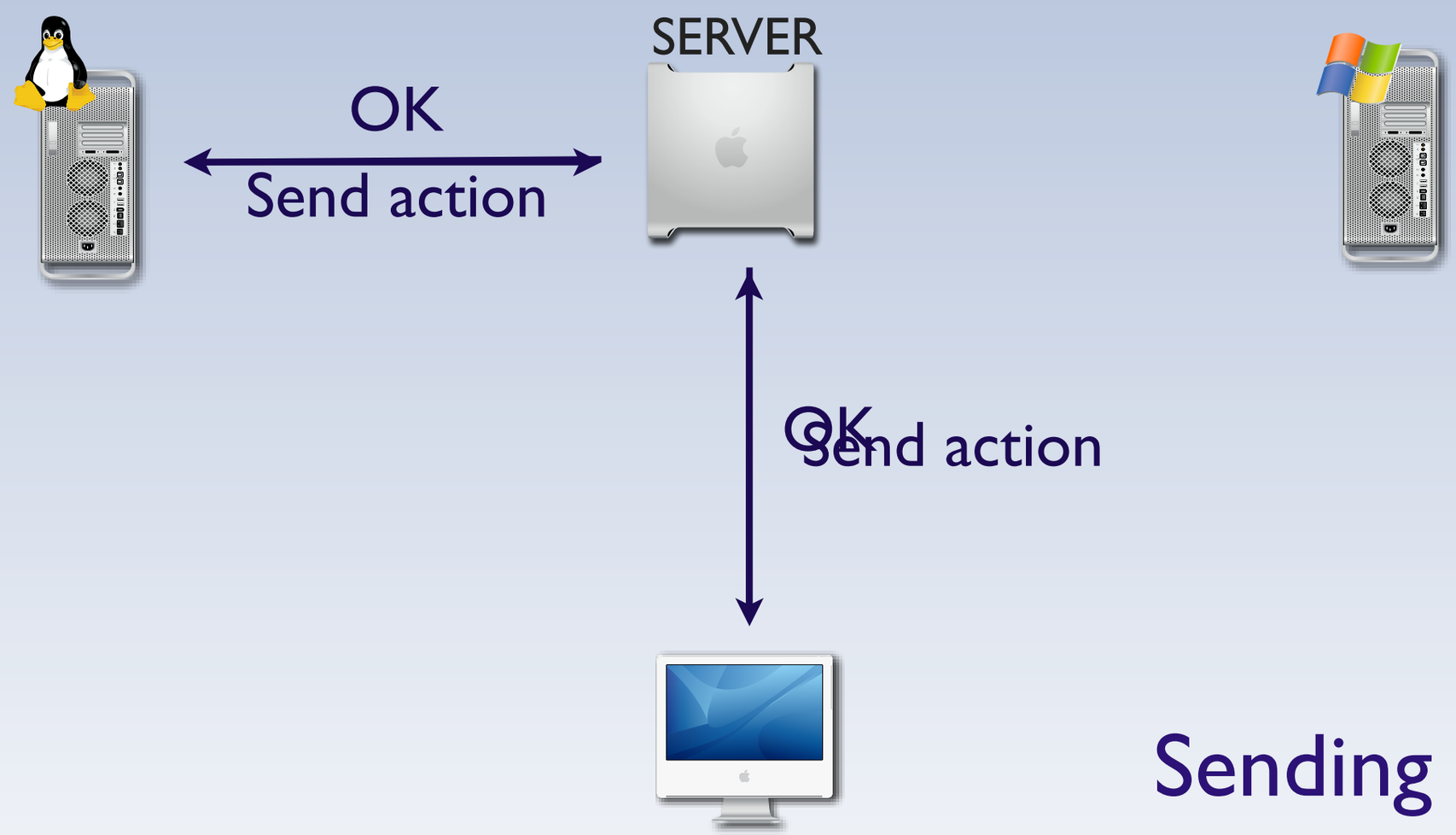
System's functionality



Game starts!

Development

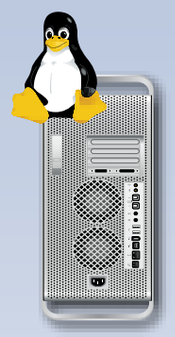
System's functionality



Sending actions

Development

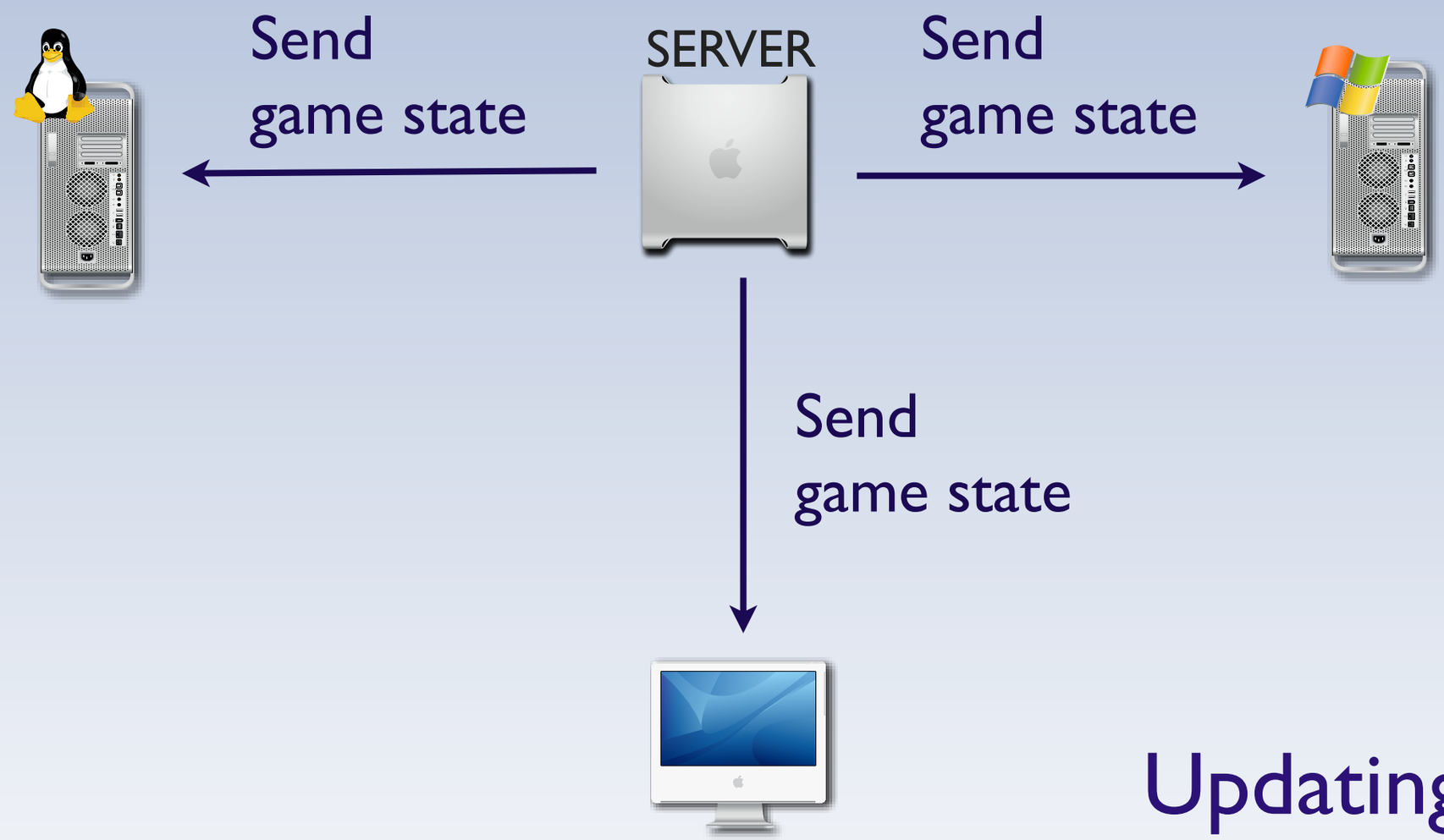
System's functionality



Updating
game state

Development

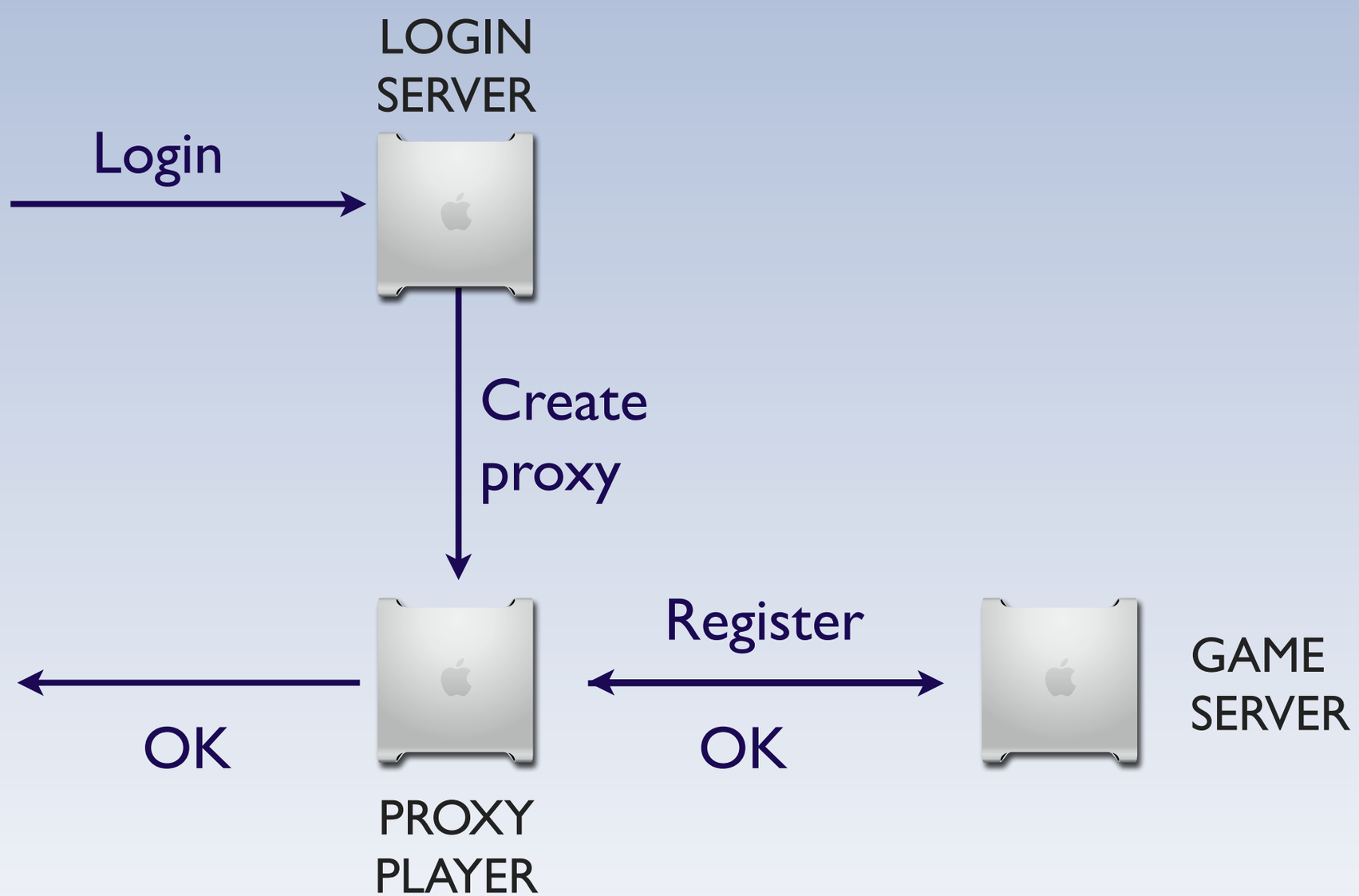
System's functionality



Updating
game state

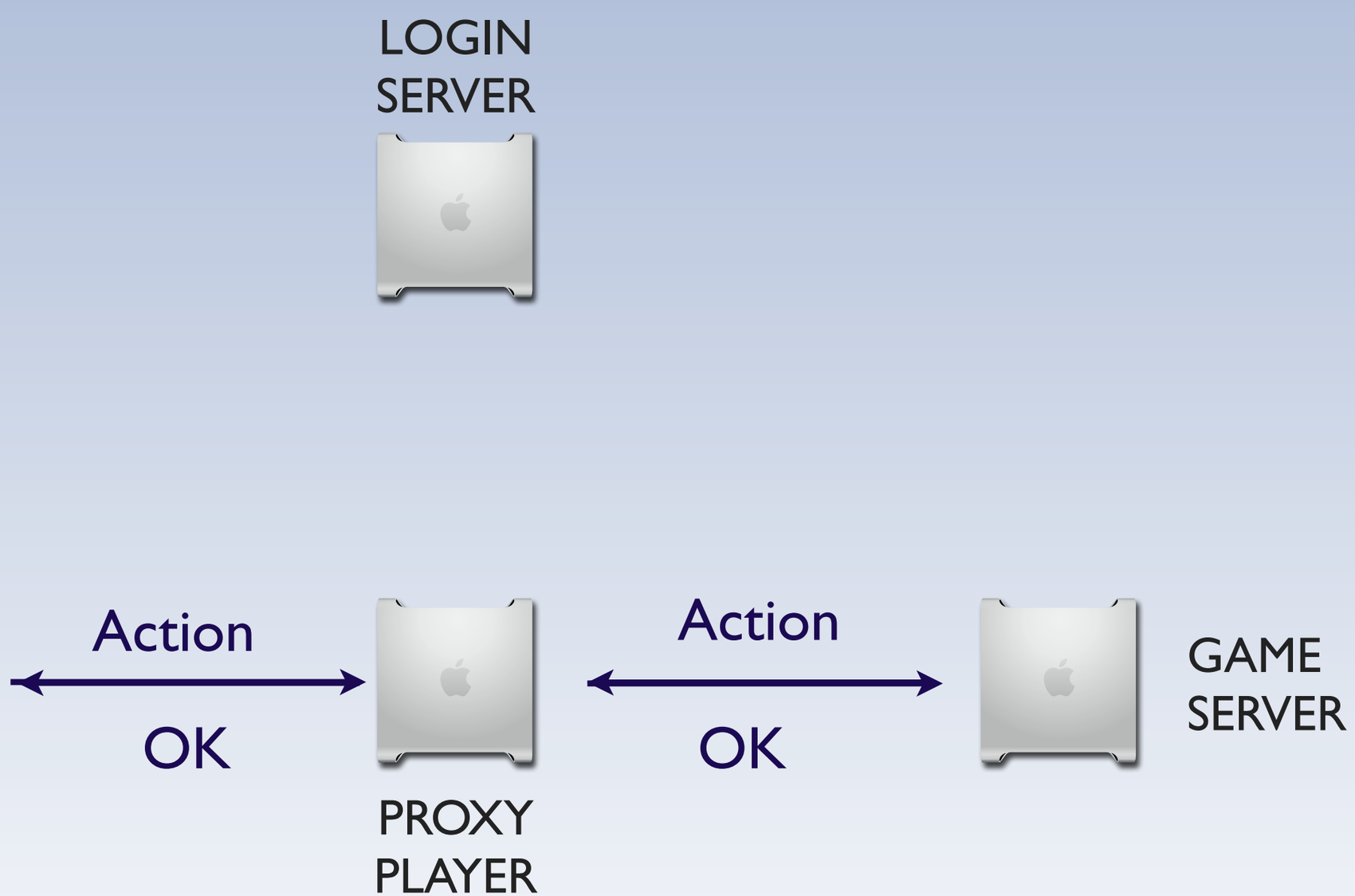
Development

Server's functionality



Development

Server's functionality



Development

Server's functionality

Development

Implementation

System:

- Game functionality
- Signal propagation
- Players' perceptions

AI player:

- Production system
- Other techniques

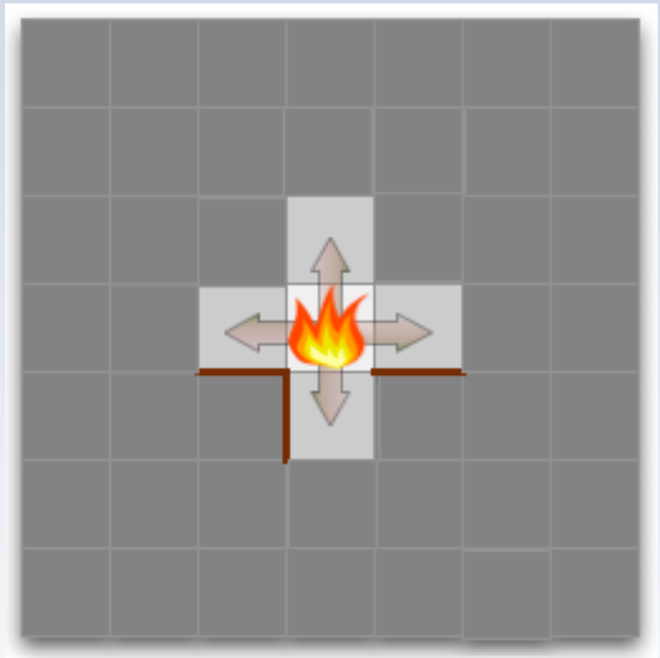
Signal propagation - Light

Characteristic:

- Intensity

Propagation's algorithm

- Non-directional



Development

Signal propagation - Sound

Characteristics:

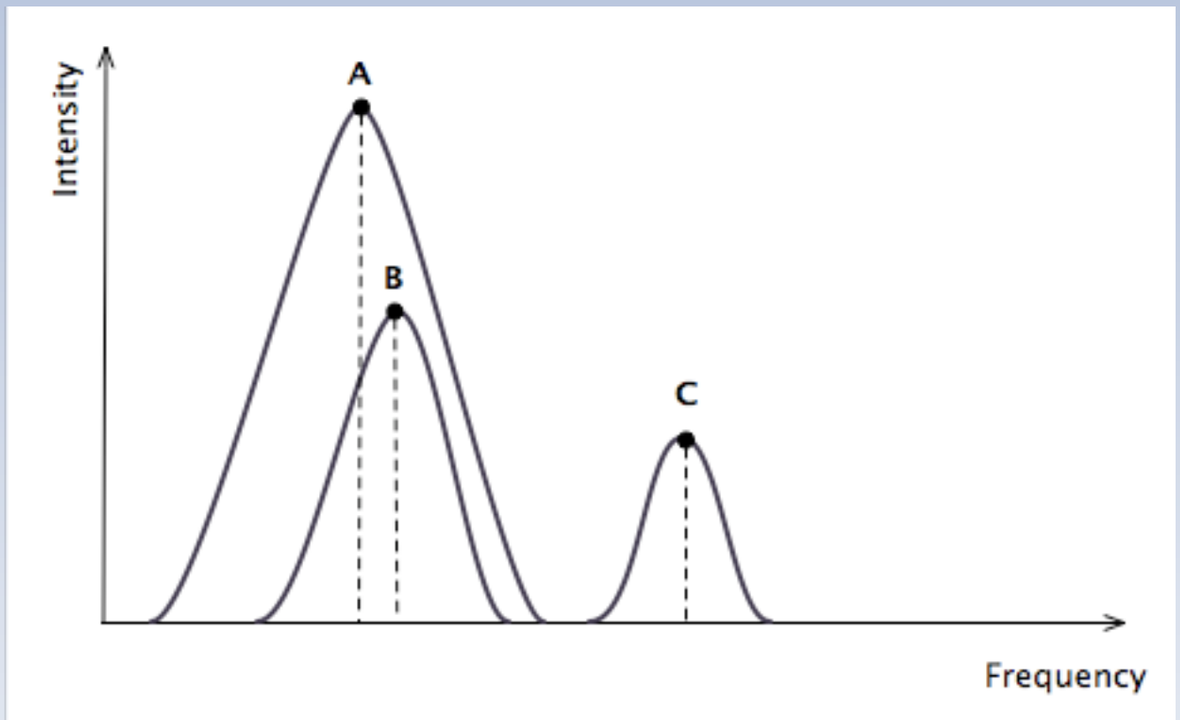
- Frequency
- Intensity
- Type

Propagation's algorithm

- Non-directional
- Masking effect

Signal propagation - Sound

- Masking effect



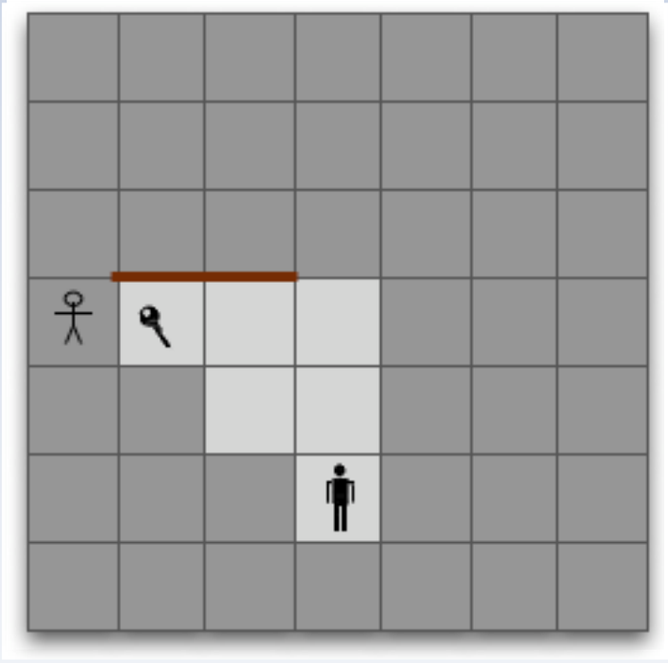
A is heard
B is masked by A
C is heard

Players' perceptions - Visual

1.- Computation of range of vision

2.- Reducing range of vision

3.- Notification of the perceptions



Development

Players' perceptions - Visual

3.- Notification of the perceptions

- Probability value
- Hierarchical structure

Probability:

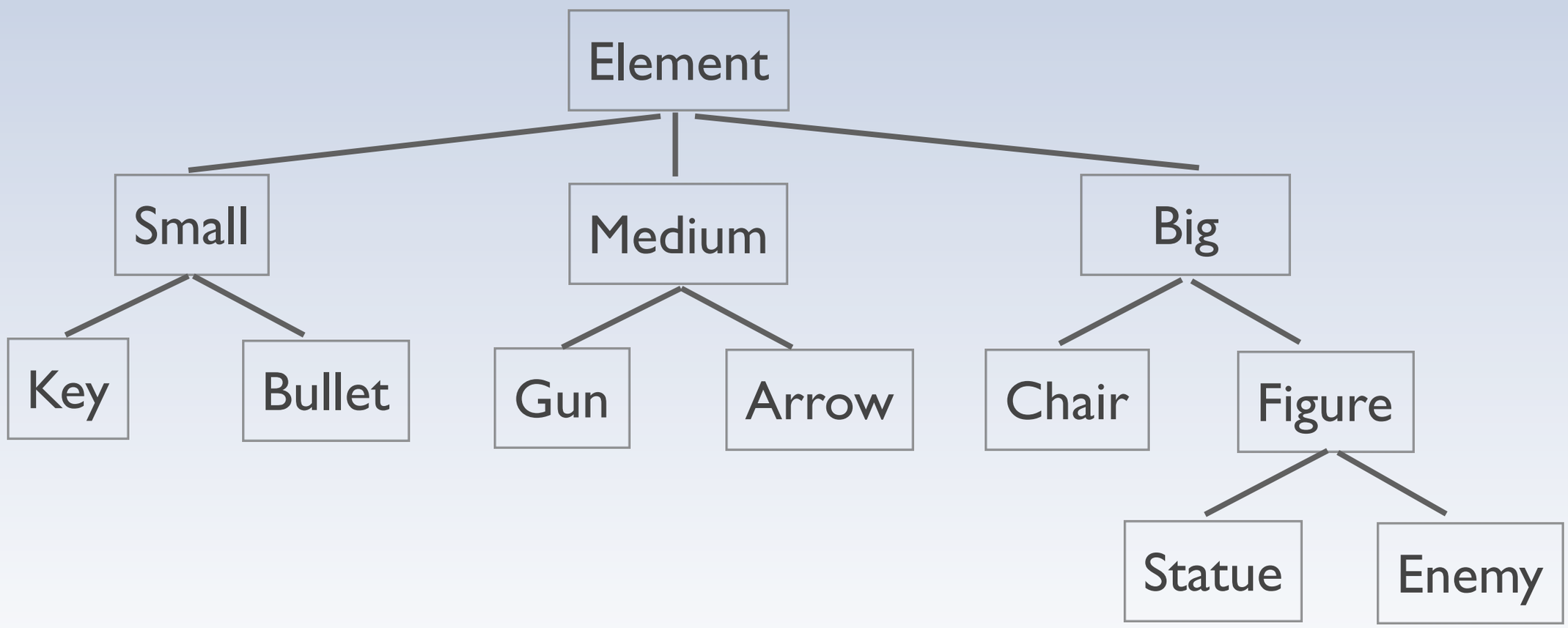
- Light
- Distance
- Size
- Attenuation of blocking elements

Development

Players' perceptions - Visual

3.- Notification of the perceptions

- Probability value
- Hierarchical structure



Development

Players' perceptions - Auditive

Perception levels:

- Strong:
  - Type of the sound
  - Direction of the sound

- Middle: - Type of the sound

- Low: - No extra information

Production system

Concepts

- Subgoals: “Open door”, “find key”, “go to”,...
- Goals: Set of subgoals
- Behaviour modes: “go to pick up”, “unlock door”, ...

Go to goal

Go to goal

Unlock door

Pick up key

Pick up key

Development

Production system

Concepts

- Subgoals: “Open door”, “find key”, “go to”,...
- Goals: Set of subgoals
- Behaviour modes: “go to pick up”, “unlock door”, ...

Other techniques:

- Replanning
- Pathfinding

EXPERIMENTATION

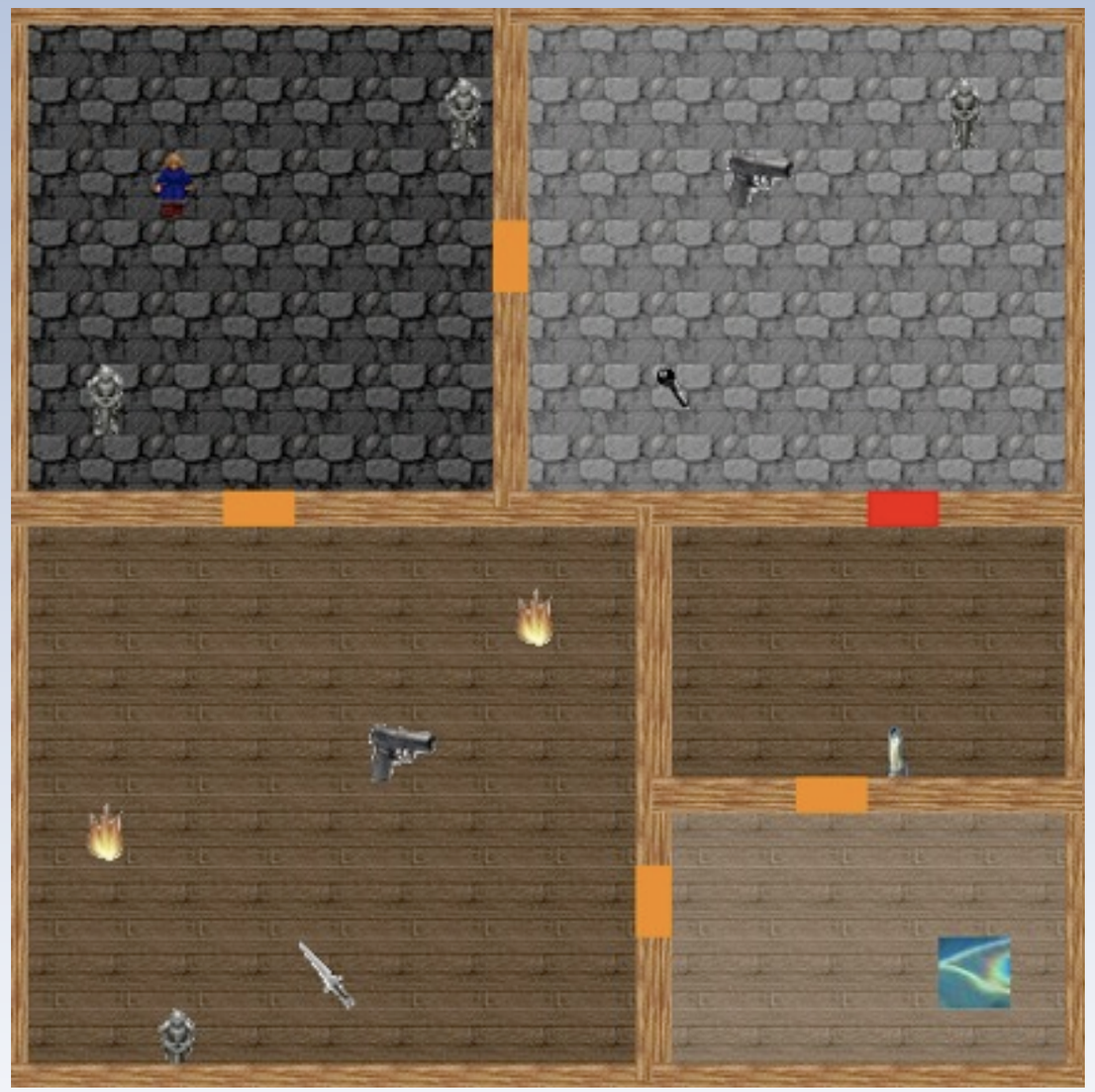
Two modes:

- Single player mode
  - 2 scenarios

- Multiplayer mode
  - Against 4 human players
  - 3 scenarios

Single player mode

Domains:

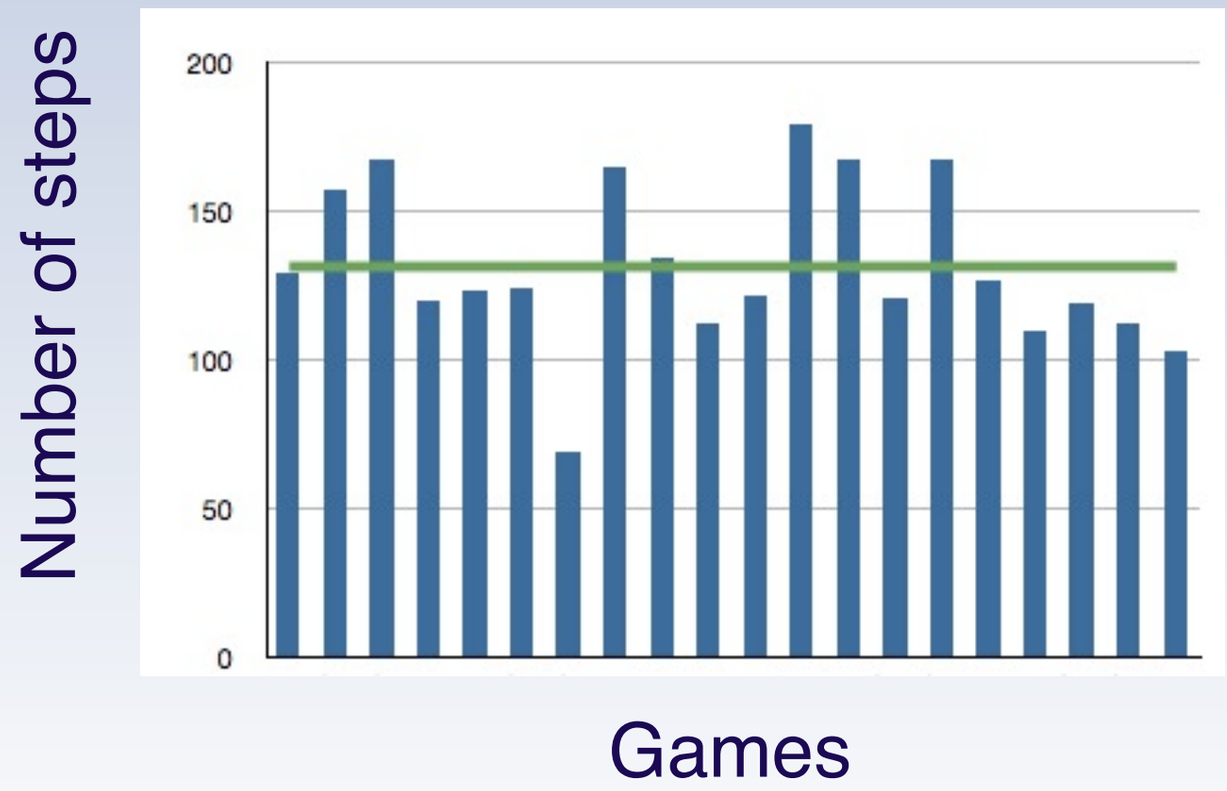


Experimentation

Single player mode

Results:

- Good performance
- Constant results
- Deterministic



Experimentation

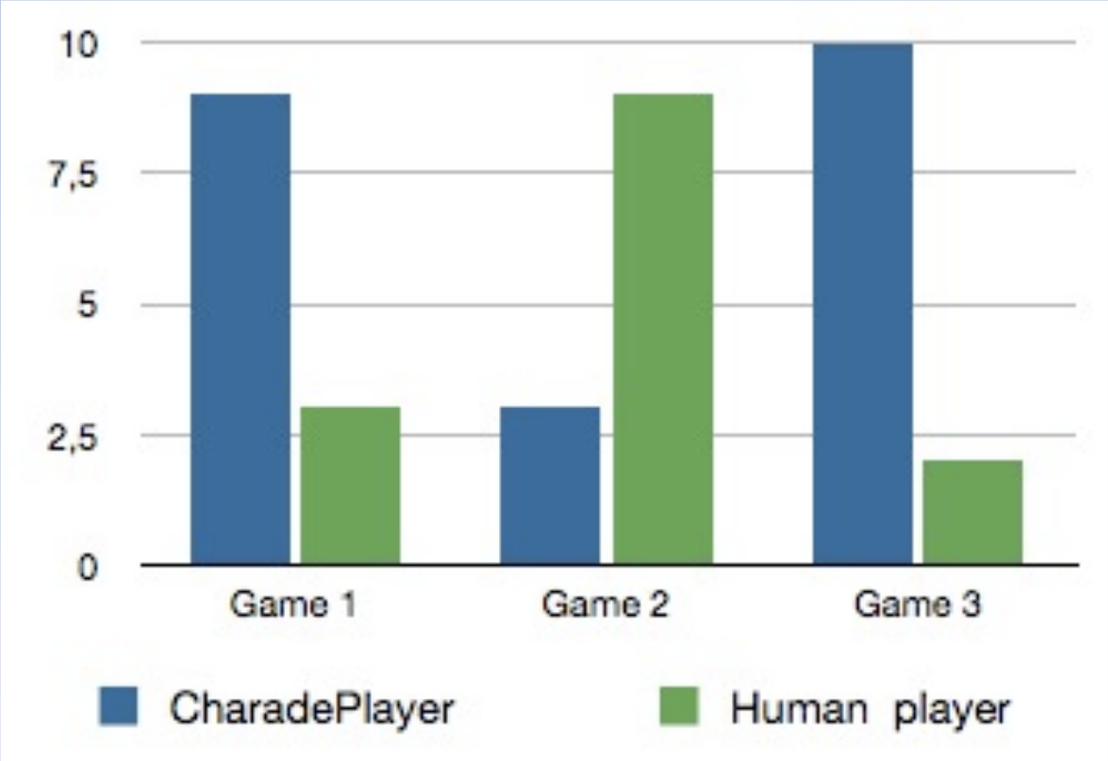
Multiplayer mode

Domains:

Experimentation

Multiplayer mode

Results:



- Won 61% of the games
- Good results in games 1 and 3

CONCLUSIONS

System:

- Portable system
- Distributed execution
- Expandable
- Realistic environment

CONCLUSIONS

AI player

Advantages

- Simple technique
- Competitive player

Disadvantages

- Very predictable
- Not very reactive
- Not easy to expand

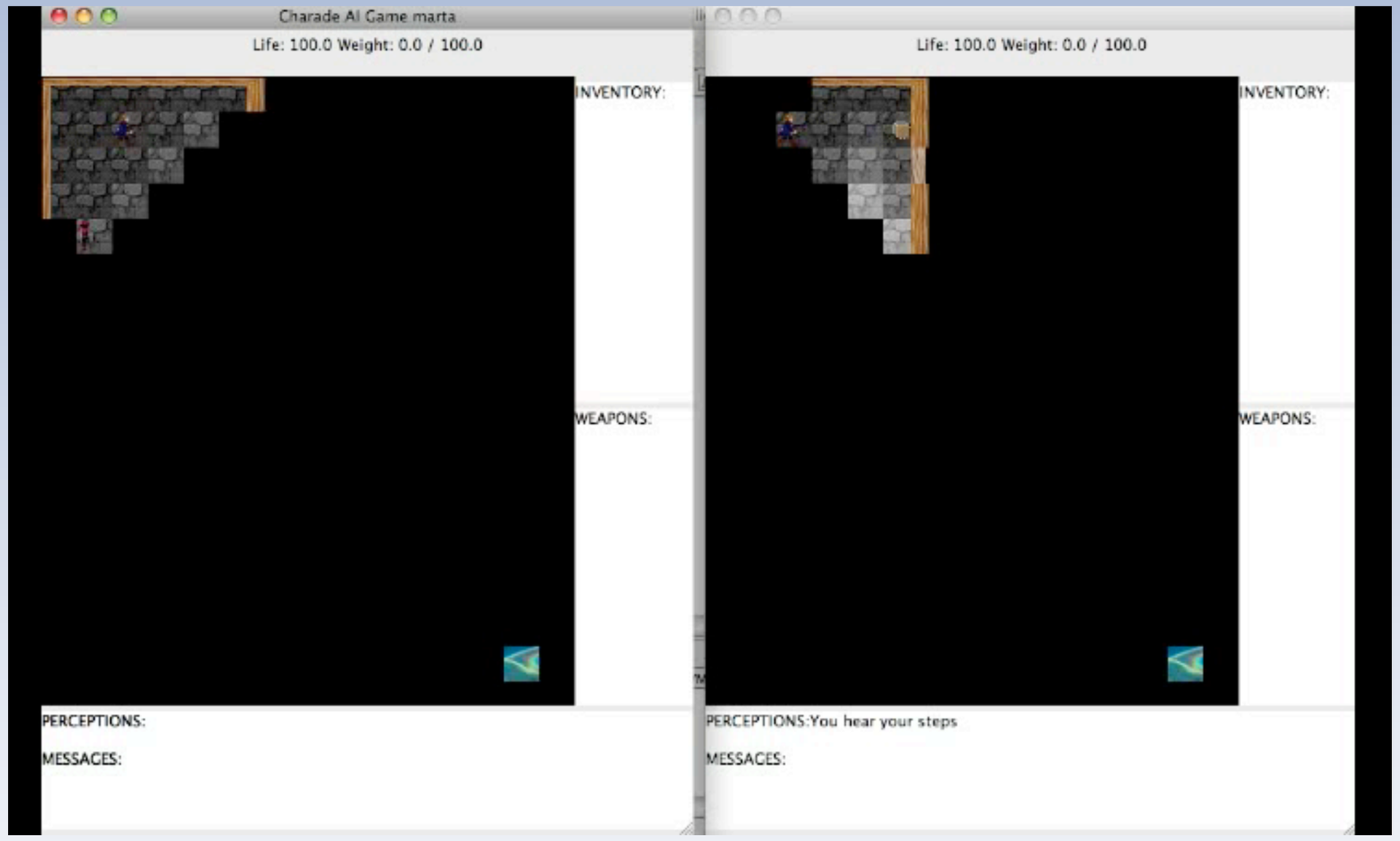
CONCLUSIONS

Future lines

- Planning
- Adversarial search
- Temporal inference
- Handling uncertainty

DEMO

Playing a game



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