CIVILIZATION ALPHA

Project CyberSym

Your wish is my command – if you fulfill mine.

An Agent-Based Simulation of Multi-Stage Production Processes

Janosch Haber
Supervisor: Dr. Roberto Valenti

UNIVERSITY OF AMSTERDAM

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Project CyberSyn (1971)

Cybernetics and **Syn**ergy

Goal: Automatically controlling the Chilean industry based on Stafford Beer's **Viable Systems Model**

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Cybernetics and **Syn**ergy

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Project CyberSym

Cybernetics and **Sym**biosis

Goal: Model a resource distribution network that is primarily based on **resource availability.**

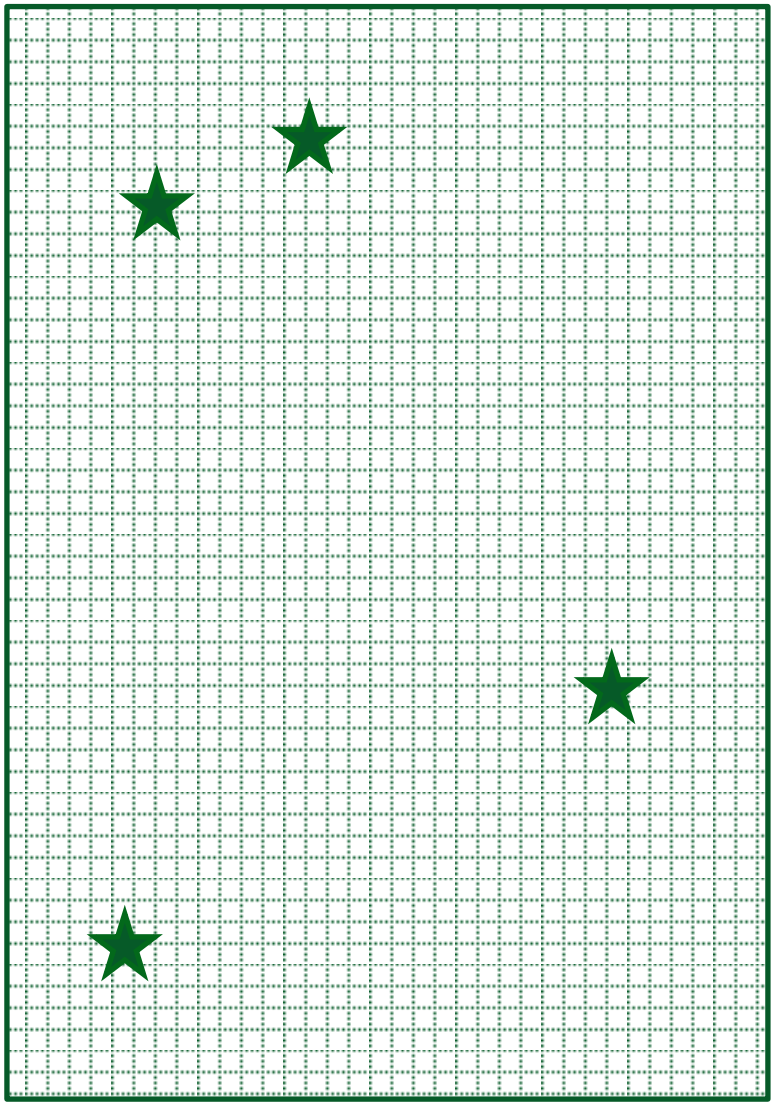
1

Project CyberSym

Cybernetics and **Sym**biosis

Use of distributed, local intelligence (in the form of heuristic functions) and emergent structures

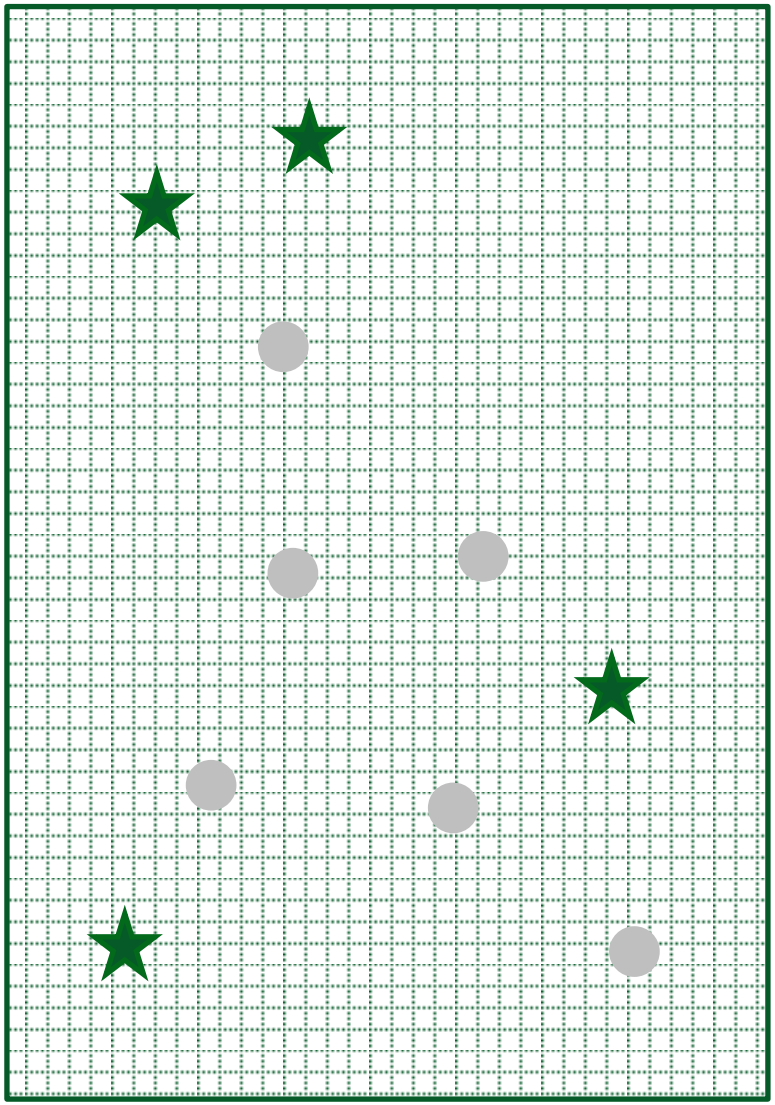
Research Question: Under which parameter settings will the modelled system develop an optimal Resource Distribution Network?



Project CyberSym

Cybernetics and **Sym**biosis

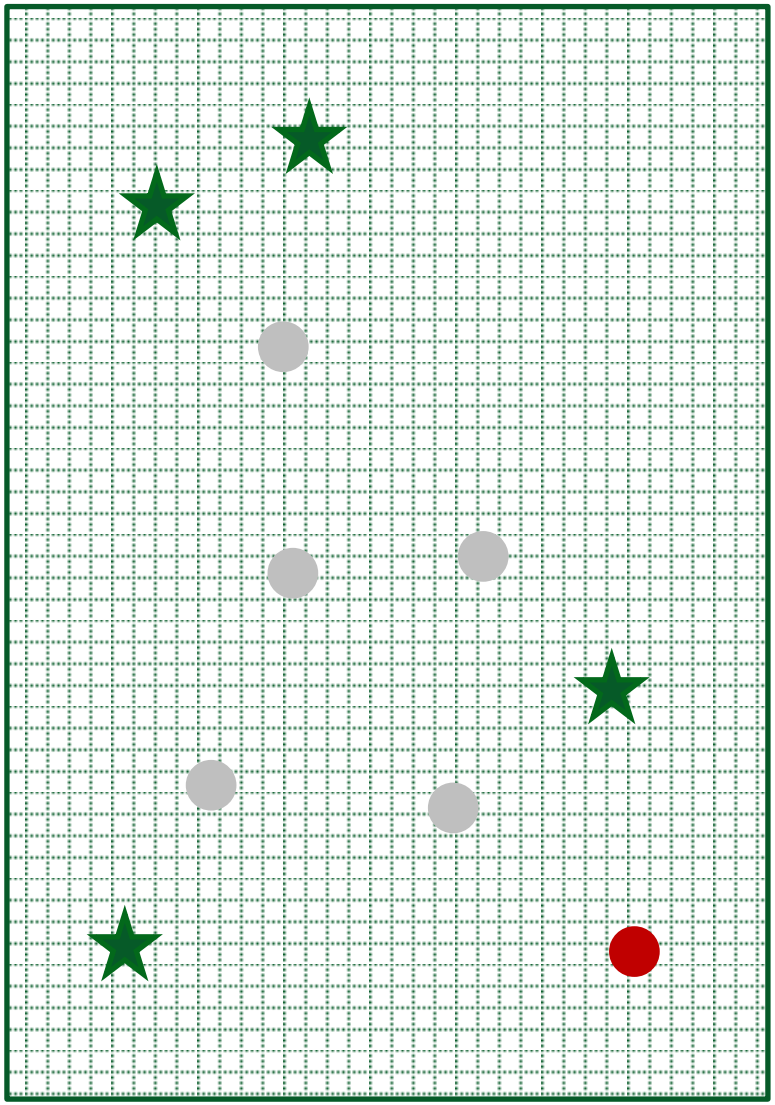
1) Environment with Resources



Project CyberSym

Cybernetics and **Sym**biosis

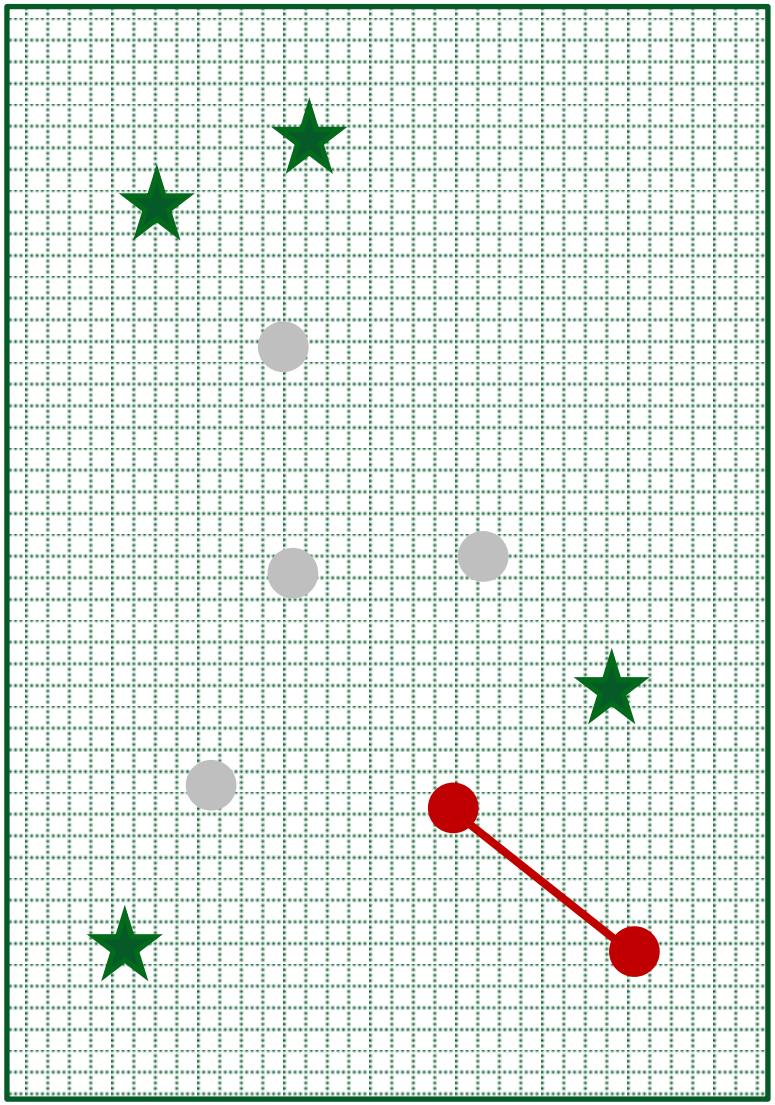
1) Environment with Resources
2) Static Agents (limited Range)



Project CyberSym

Cybernetics and **Sym**biosis

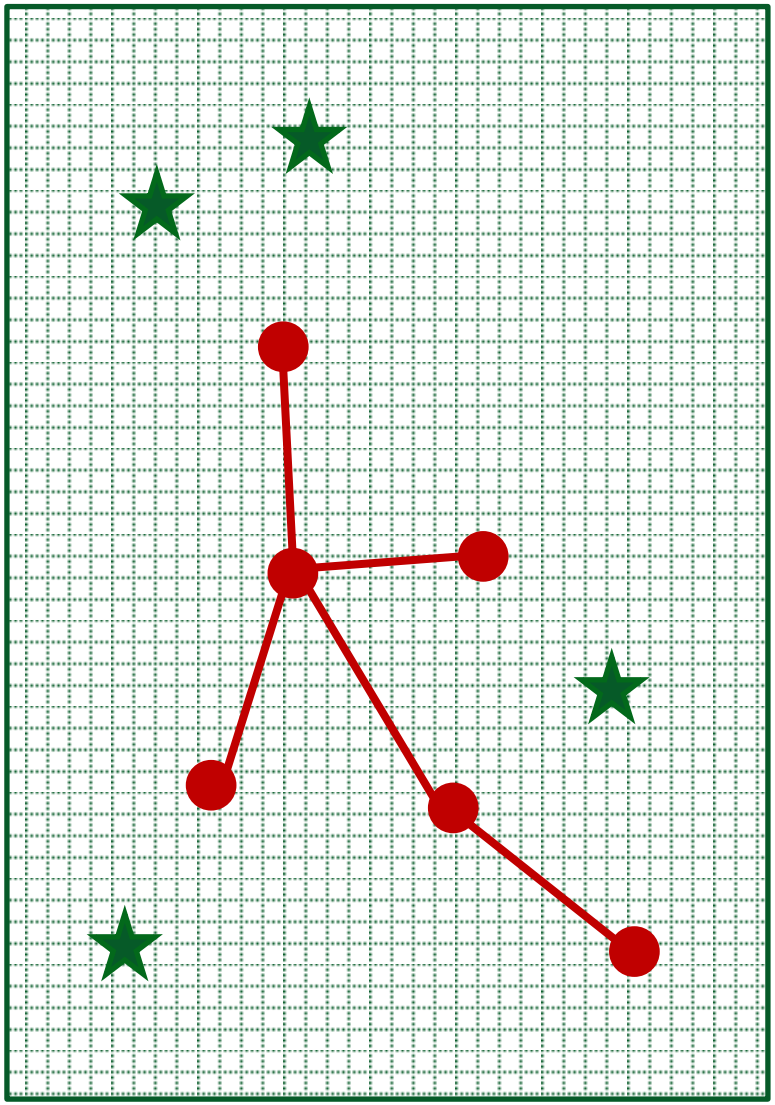
1) Environment with Resources
2) Static Agents (limited Range)
3) Generation of Demand (Wishes)



Project CyberSym

Cybernetics and **Sym**biosis

1) Environment with Resources
2) Static Agents (limited Range)
3) Generation of Demand (Wishes)
4) Distribution of Requests



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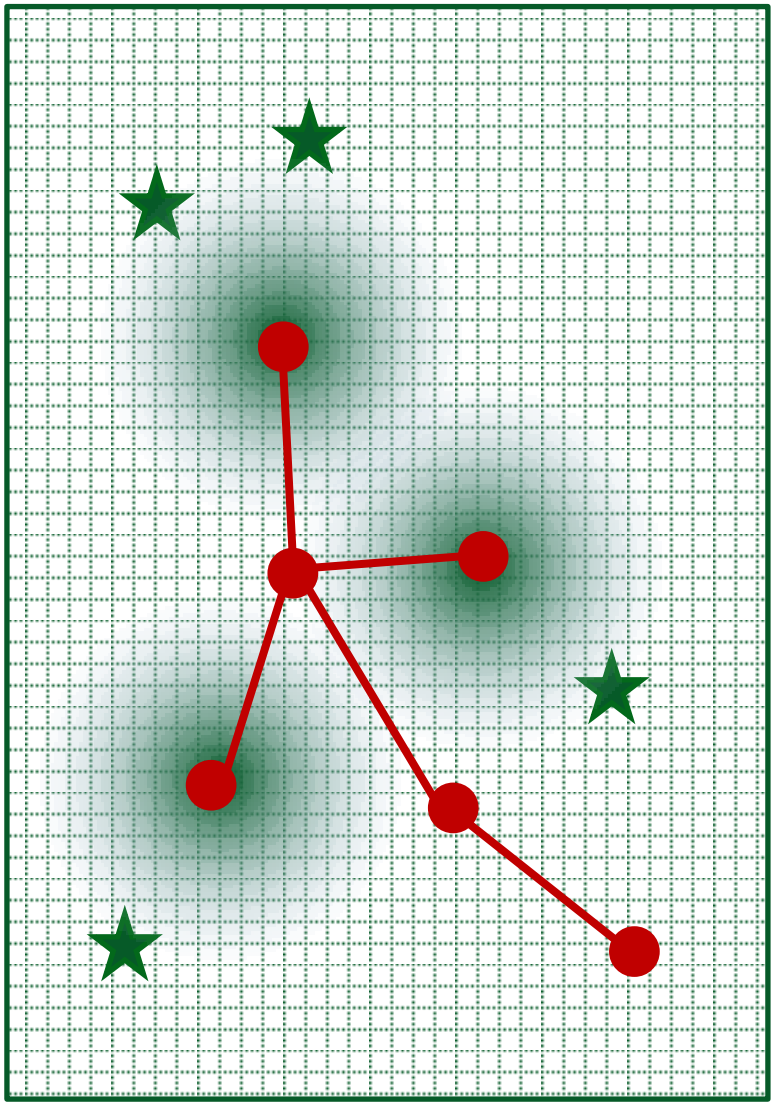

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Cybernetics and **Sym**biosis

1) Environment with Resources
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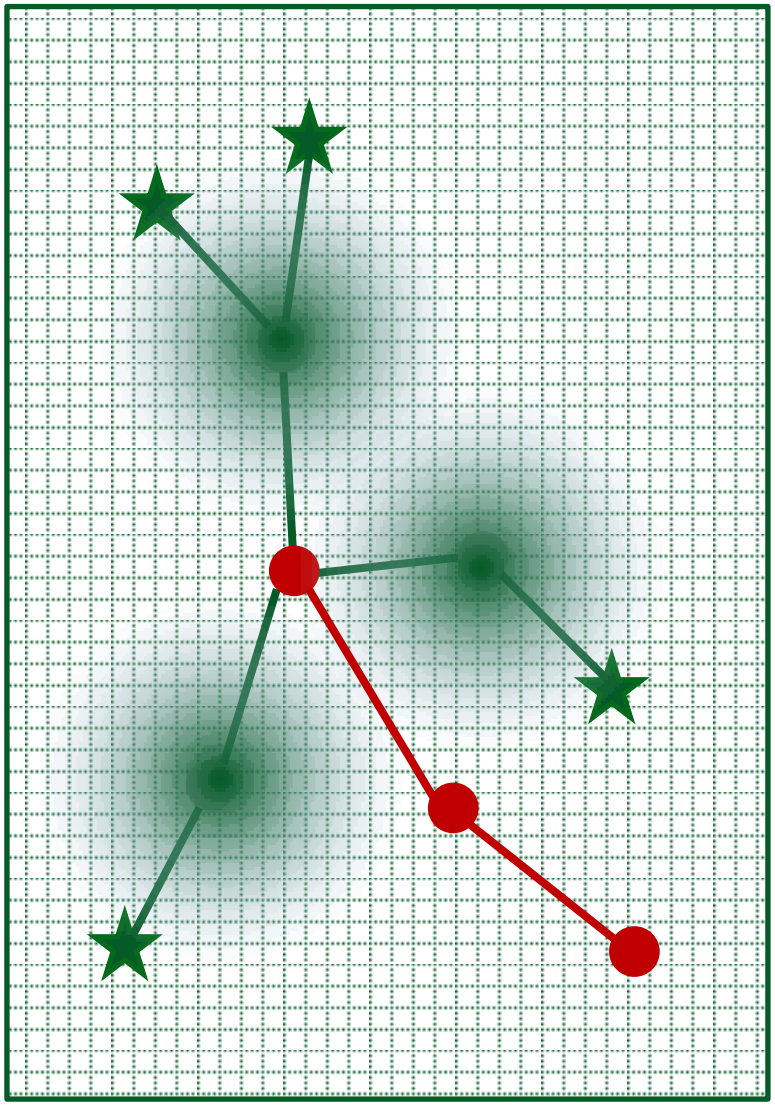
3) Generation of Demand (Wishes)
4) Distribution of Requests
5) Evaluation of Availability



Project CyberSym

Cybernetics and **Sym**biosis

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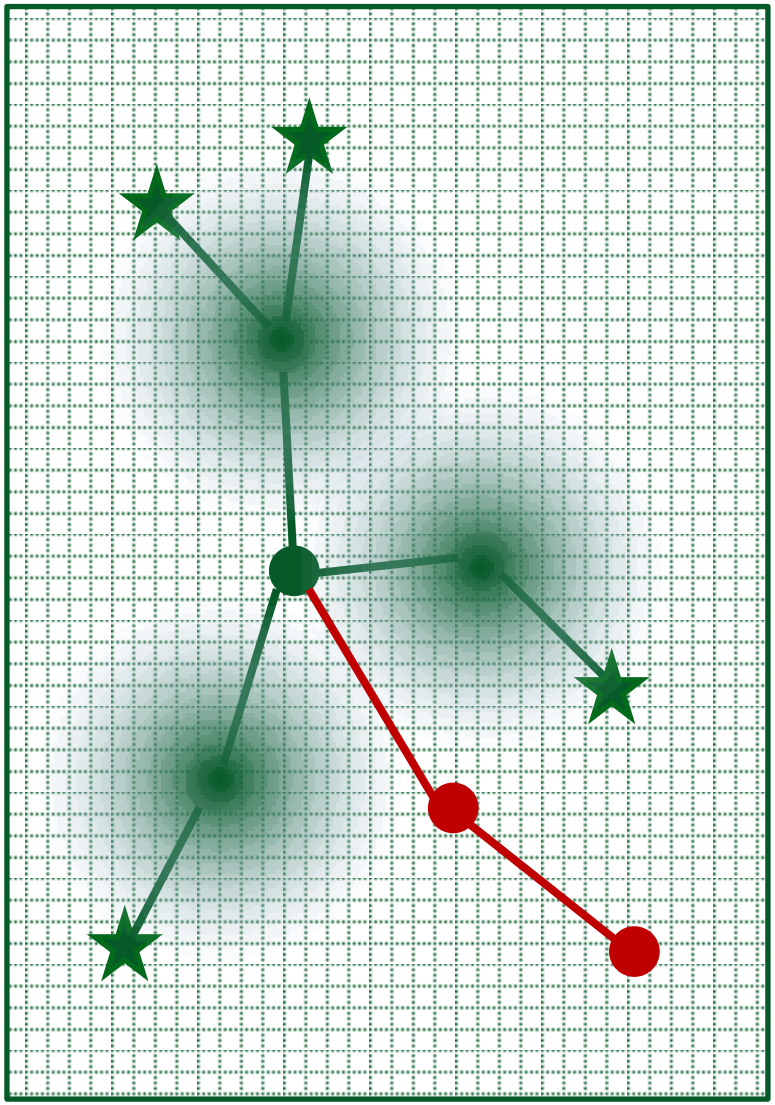
4) Distribution of Requests
5) Evaluation of Availability
6) Distribution of Resources

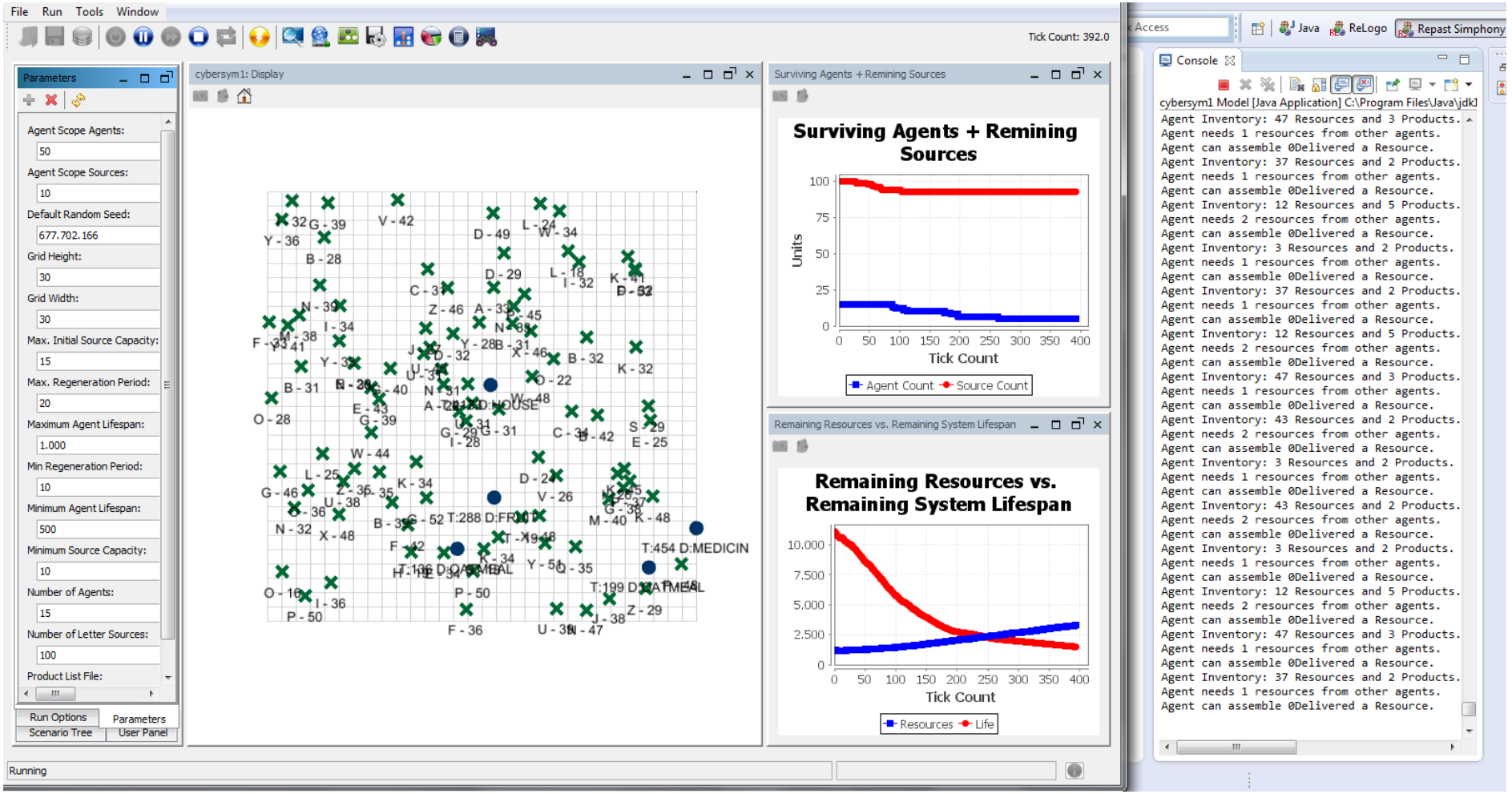


Project CyberSym

Cybernetics and **Sym**biosis

1) Environment with Resources
2) Static Agents (limited Range)
3) Generation of Demand (Wishes)
4) Distribution of Requests
5) Evaluation of Availability
6) Distribution of Resources
7) Assembly of partial Products + Transport

Alpha version Screenshots



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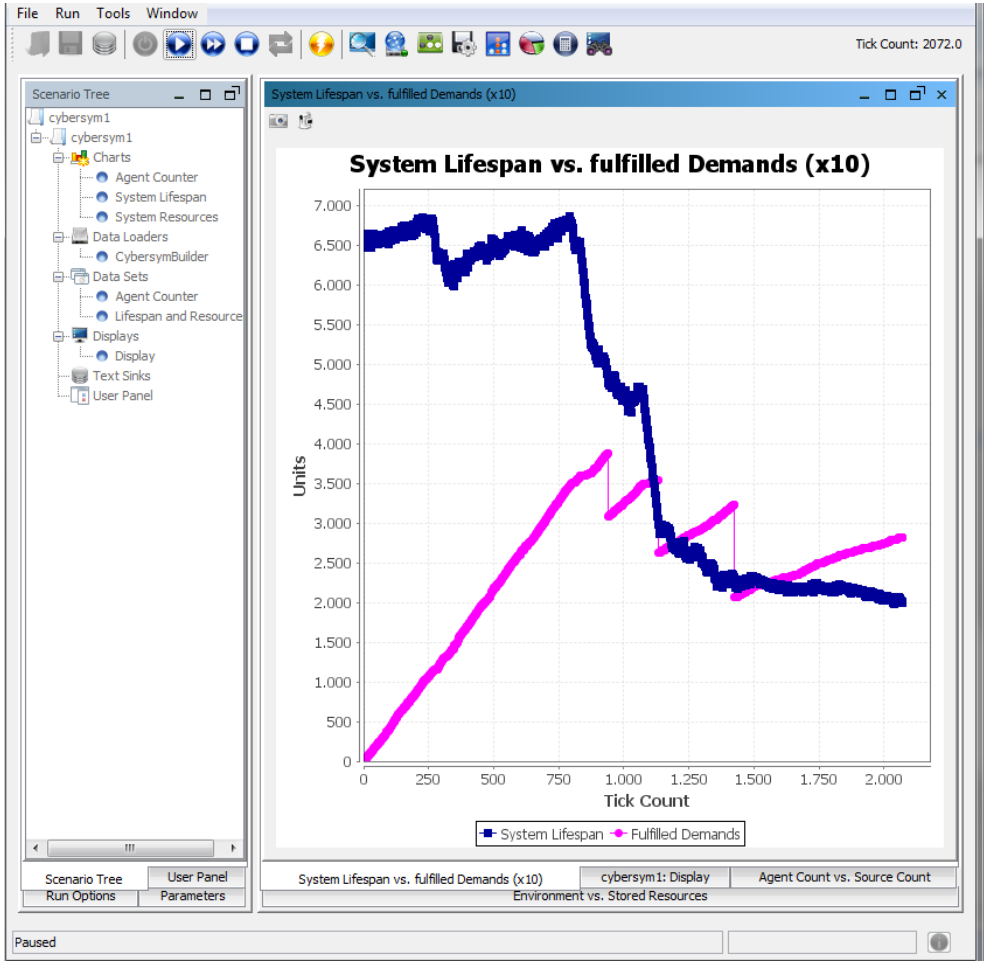
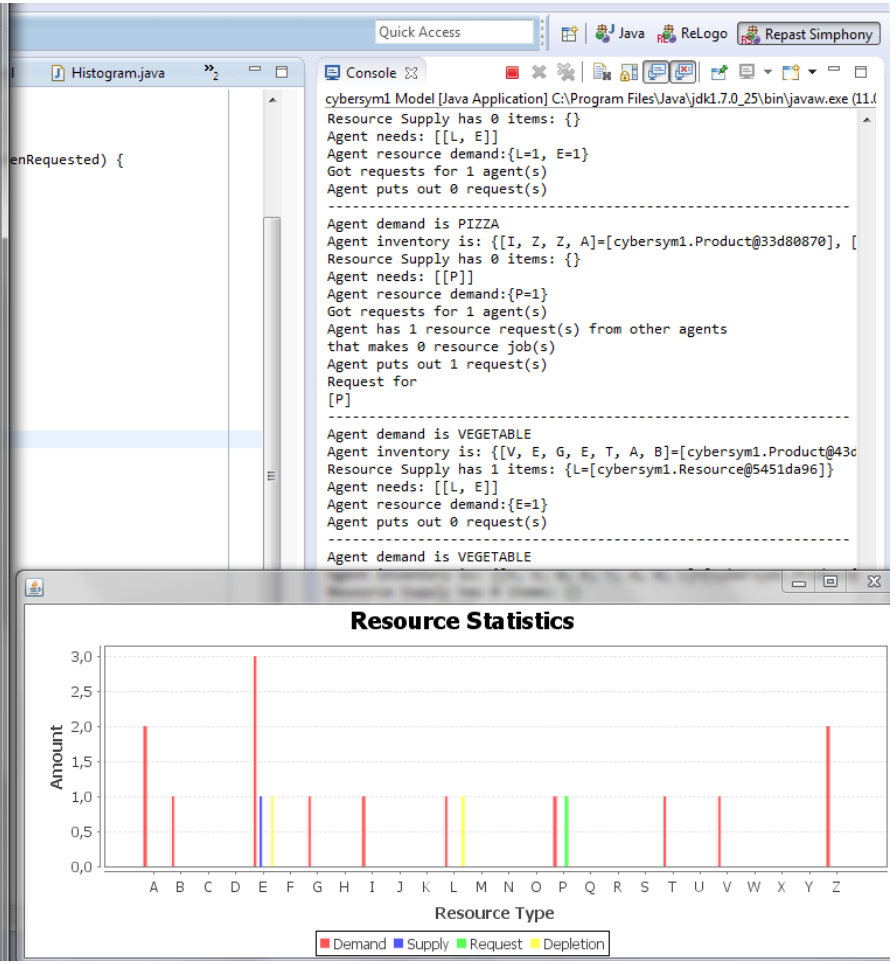




2

Beta version

- If an Agent does not succeed in fulfilling one of its wishes in 72h, it is made inactive (no energy)
- Agents are granted one new wish per 8h of work
- System goal is fulfilling as many wishes as possible

- Actions are determined based on a **heuristic utility function**

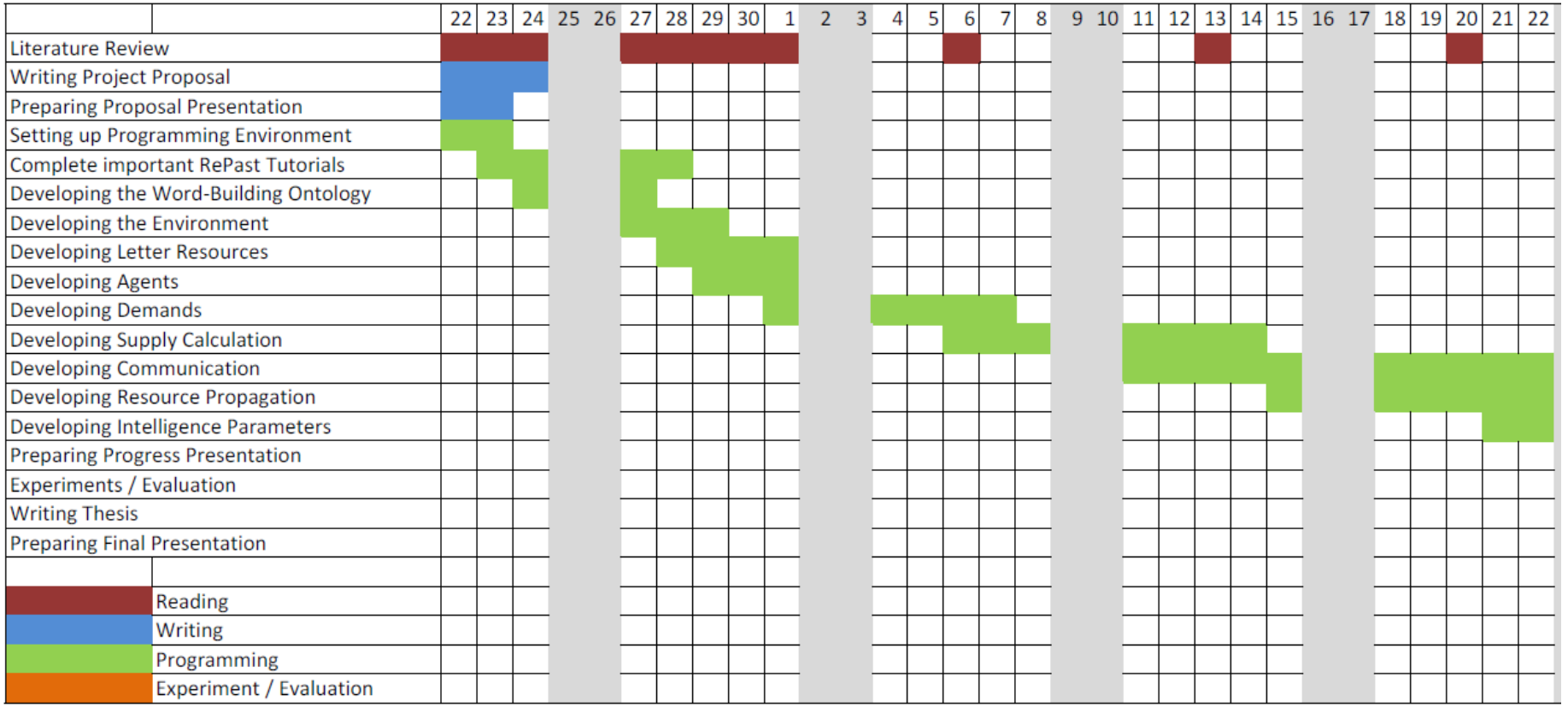
2

Assumptions

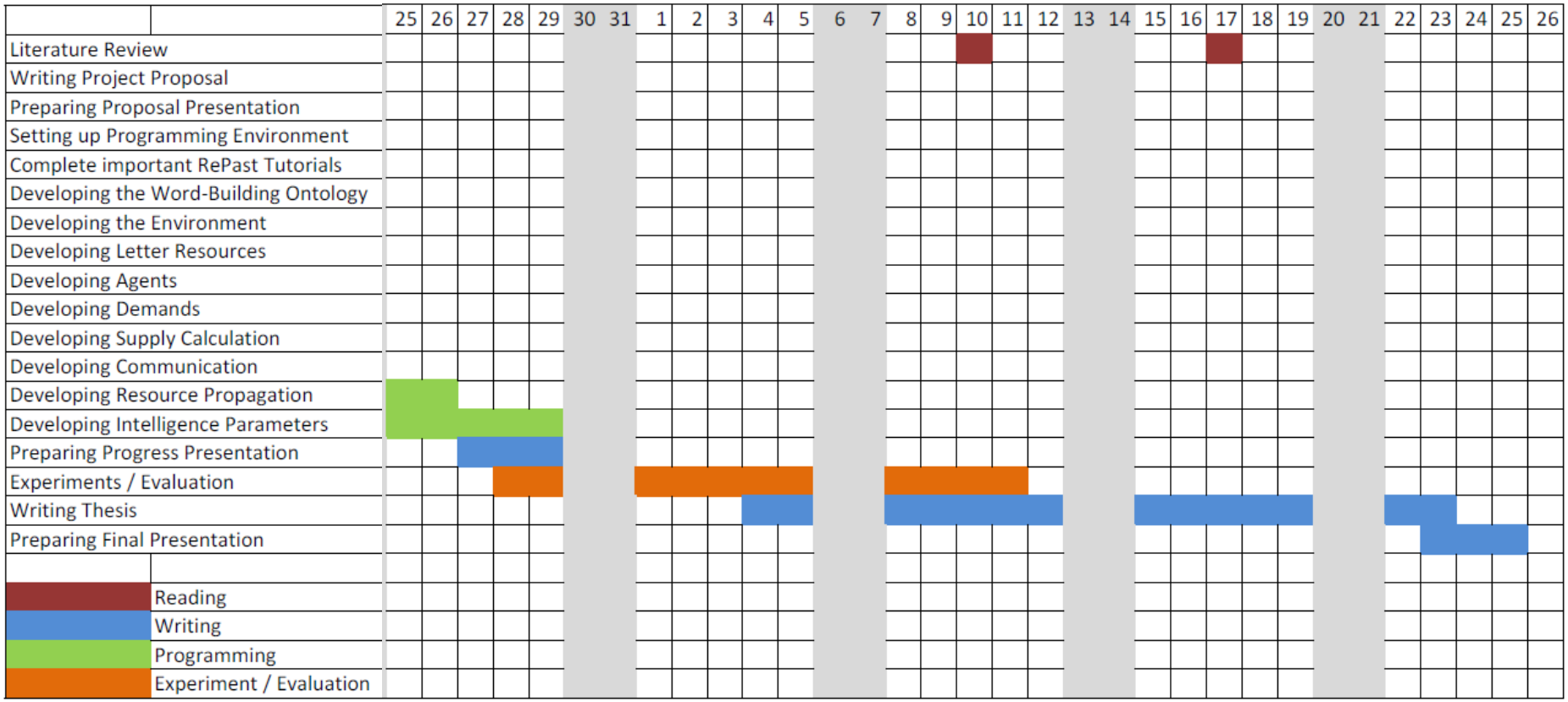
- Utility is calculated locally based on Wissner-Gross‘ new equation for intelligence **F = T ∇ Sτ**.
  1. time pressure of requesting agent
  2. resource availability
  3. amount of necessary work

- System performance is measured through
  1. System endurance
  2. Agent happiness (Wishes fulfilled)
  3. Resource consumption
  4. Production cost (time spent)

Planning (Gantt I)



Planning (Gantt II)



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Research question

Under which **parameter settings**
will an **Agent-Based Simulation**
of a **Multi-Stage Production Process**
based on **Resource Availability**
adopt an optimal
Resource Distribution Network?

2

Modelling Assumptions

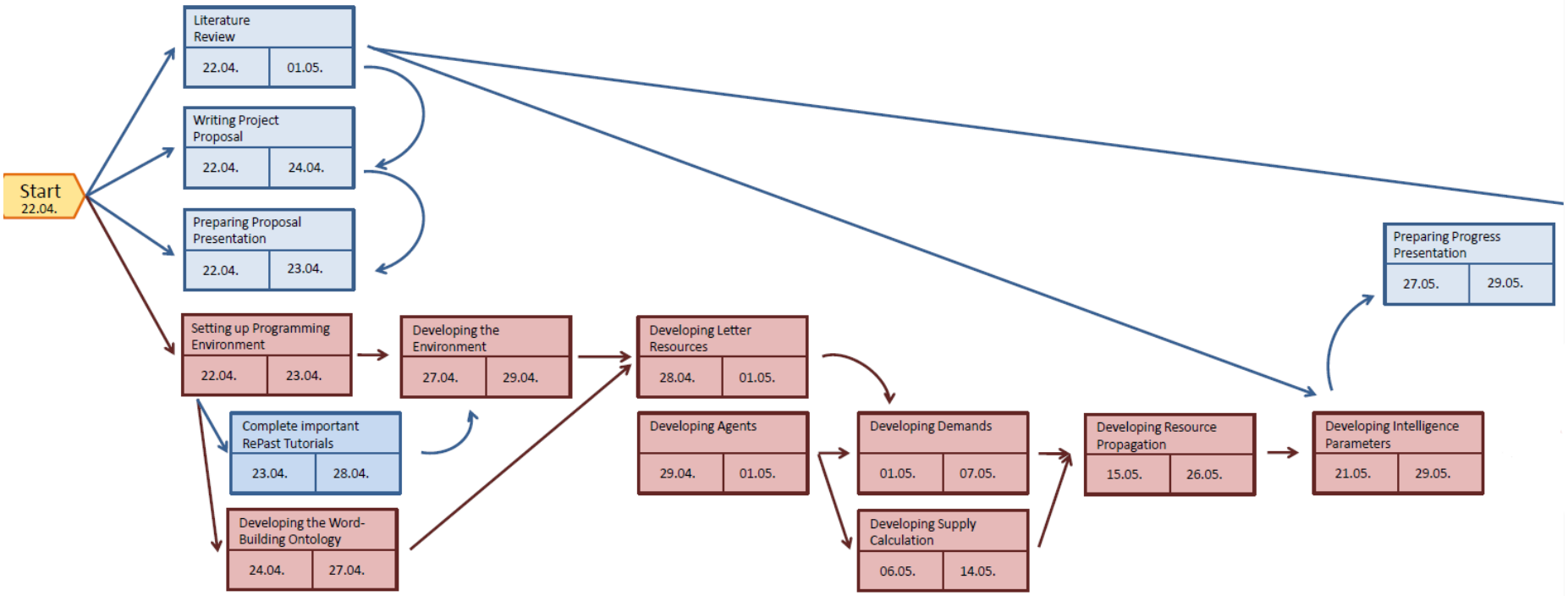
- Products are represented through words that can be assembled from letter Resources
- Agents can only contact other Agents and extract Resources within a limited range
- All actions within this range have a cost of 1
- Action utility rating is based on
  - Request importance / urgence
  - Availability
  - Distance

2

Modelling Assumptions

- All Sources are regenerative
- Agents select the highest rating possible action
- Agents can contact requesters to validate active requests

Planning (PERT I)



Planning (PERT II)

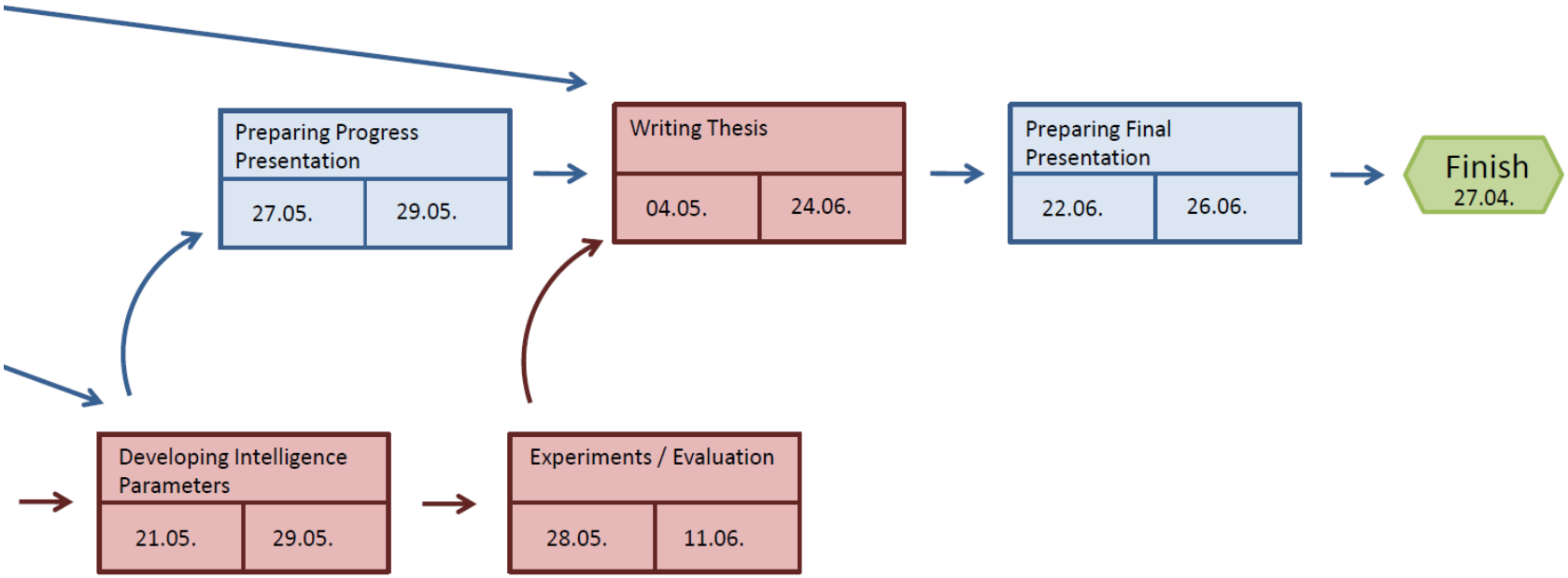


Image Sources

1) http://proyectoidis.org/wp-content/uploads/2013/07/Project-Cybersyn051.jpg
2) http://www.vanityfair.fr/uploads/images/201506/dc/vf_stafford_beer_2180.png
3) http://repast.sourceforge.net/images/Repast_logo_100h.png