An Agent-Supported Simulation Architecture for Manufacturing Systems

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Agenda

- Introduction / Motivation
- Simulation & Manufacturing
- Architecture Bases
- Simulation Process
- Conclusions / Future Work

Motivation

- Requirements of the “new manufacturing” (Shen & Norrie 1999).
- Inability of existing Simulation Tools to deal with the new manufacturing requirements (Ruiz et al 2006).
- The increasing use of the Agent Technology as the implementation tool for Manufacturing Systems.
- ANEMONA an Agent-Based Software Engineering Method for Manufacturing Systems (Giret 2005)

Simulation & Manufacturing

The Manufacturing field is an area where the application of simulation is an essential tool to validate methods and architectures before applying them on the factory floor.

Any Manufacturing Simulation tool needs:

- A Model that provides the representation of specific parts/elements of manufacturing equipment and their control.
- Manufacturing Installations Model to emulate the equipment physically.
- Execution Interface.
- Graphic visualization of the global behavior of the system.

Simulation & Manufacturing

- An extensive evaluation study of current representative simulation tools have observed some weaknesses to deal with the new manufacturing requirements (Ruiz et al 2006)

Our proposal

An Agent-Supported Simulation Tool for Manufacturing Systems

Main characteristics:

- Exploitation of flexibility,
- Control Distribution,
- Emulation of complex behaviors, and
- Management of necessary elements according to the system current state,
- Multiagent System Characteristics.

Simulation Tool

Characteristics (Nikouaran 1999) :

1) Database Maintenance,
2) Animation display,
3) Animation running mode,
4) Input Modes,
5) File Creation,
6) Interface,
7) Input Data Analysis,
8) Tracing Capability,
9) Interactive Debugger,
10) Model Execution Speed,
11) Manufacturing Features,
12) Library of Icons,
13) Model Development,
14) Independent Replications,
15) Customized Reports,
16) Standard reports,
17) Business Graphics,
18) Dynamic Presentation,
19) Programming
20) Results analysis.

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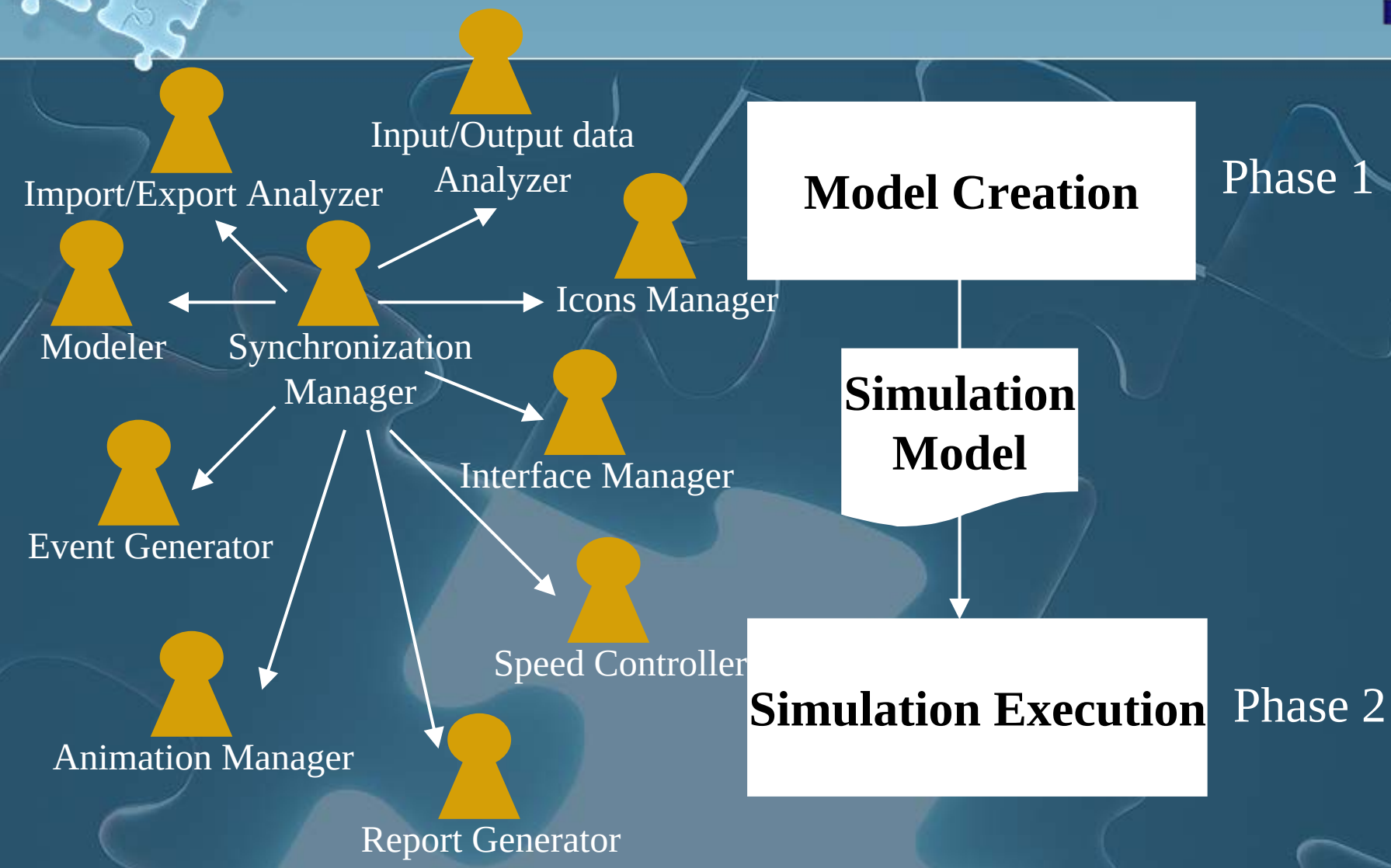
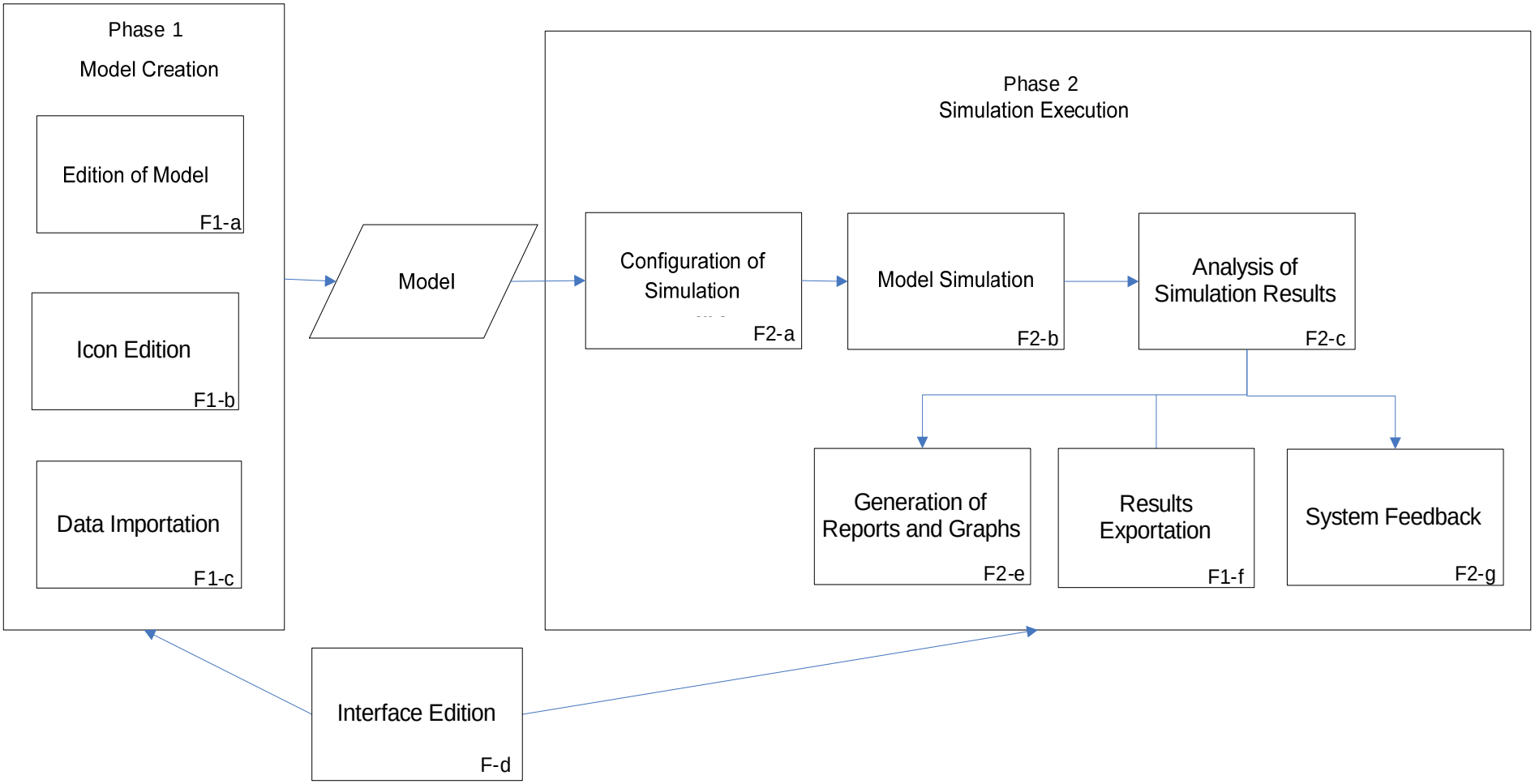
Agent Roles (Ruiz et al 2006b)

Import/Export Analyzer
Input/Output data Analyzer
Event Generator
Interface Manager
Synchronization Manager
Modeler
Icons Manager
Animation Manager
Speed Controller
Report Generator

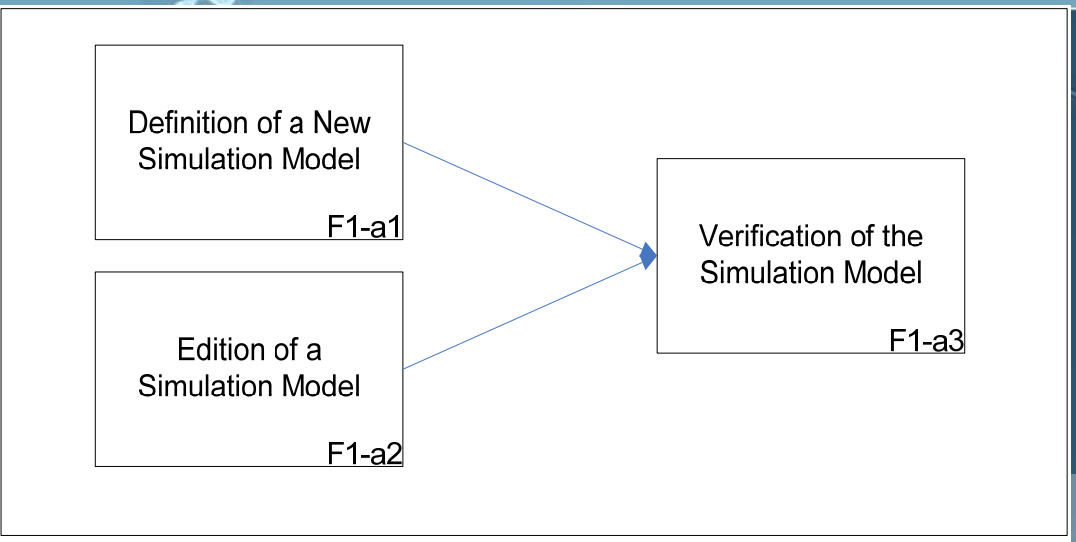
Simulation Process



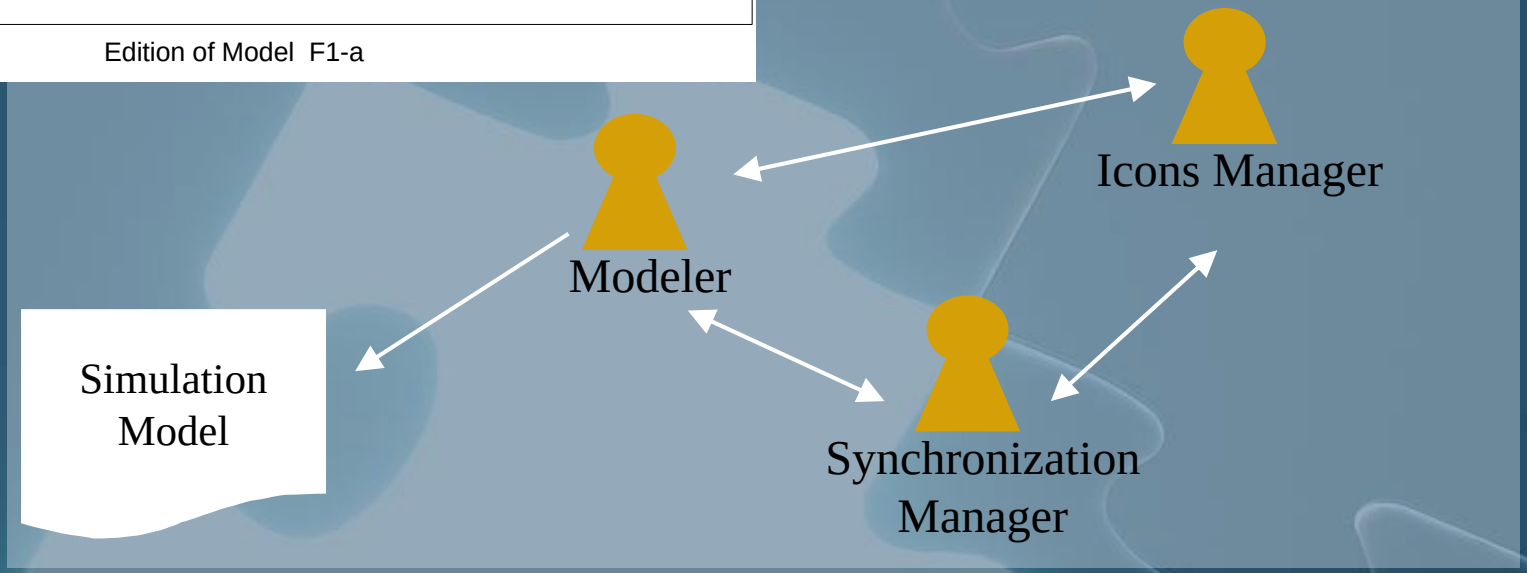
Main Scenarios



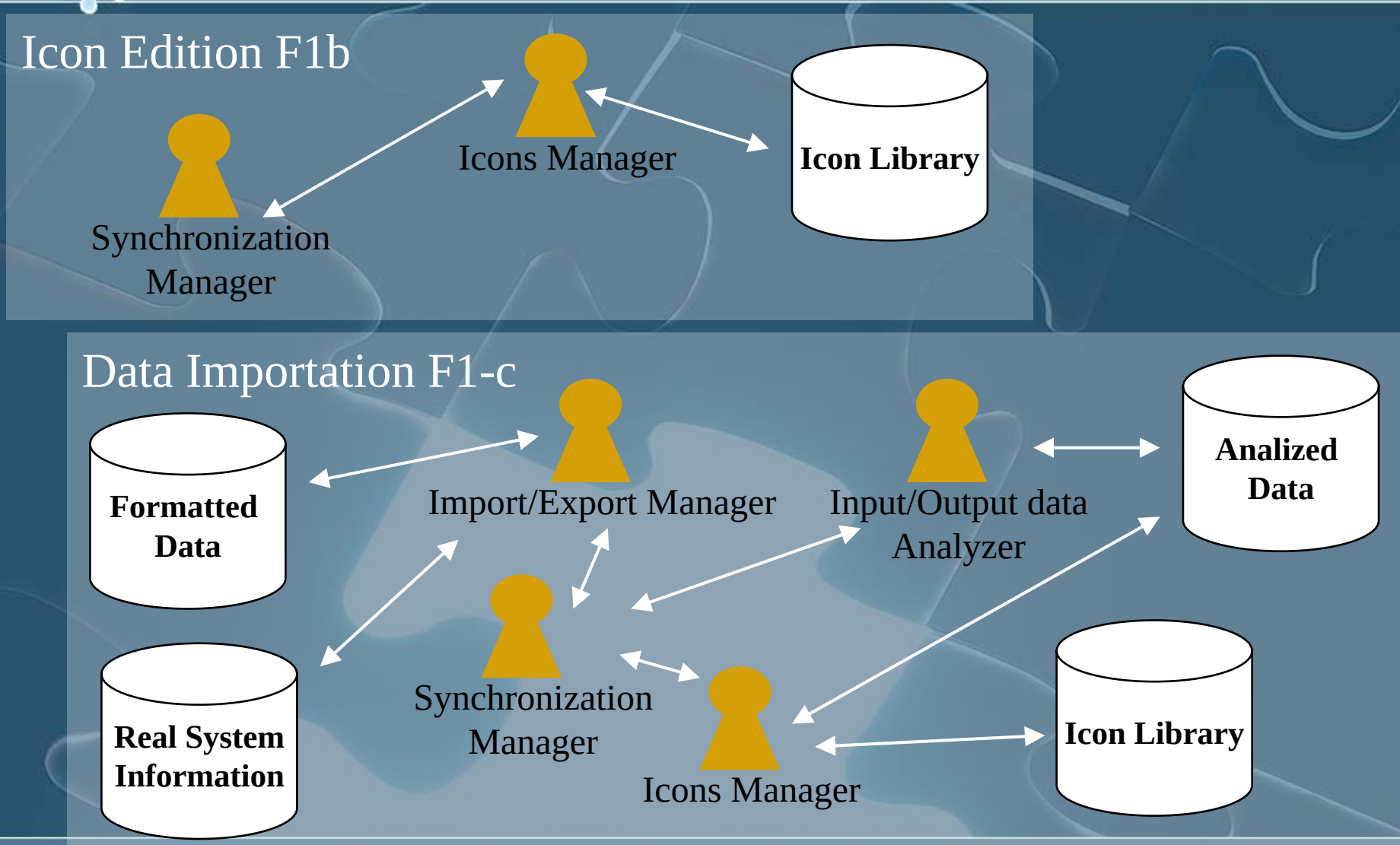
Phase 1: Scenarios - Agents F1a



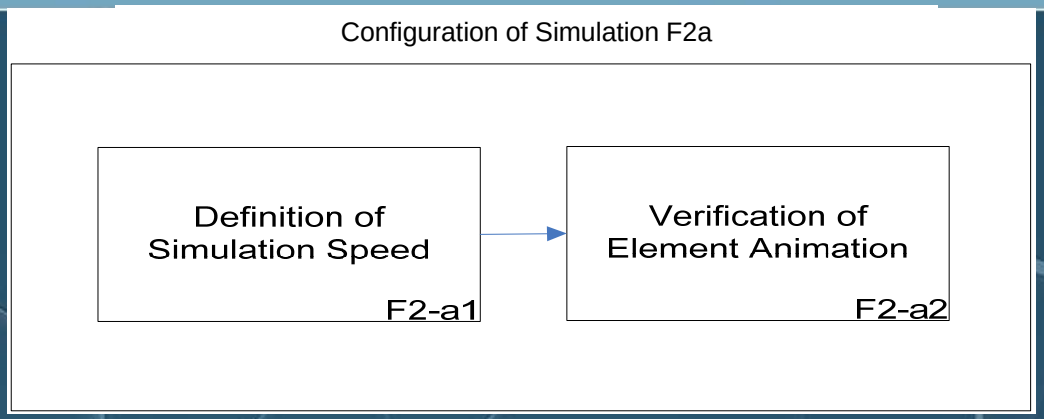
Edition of Model F1-a



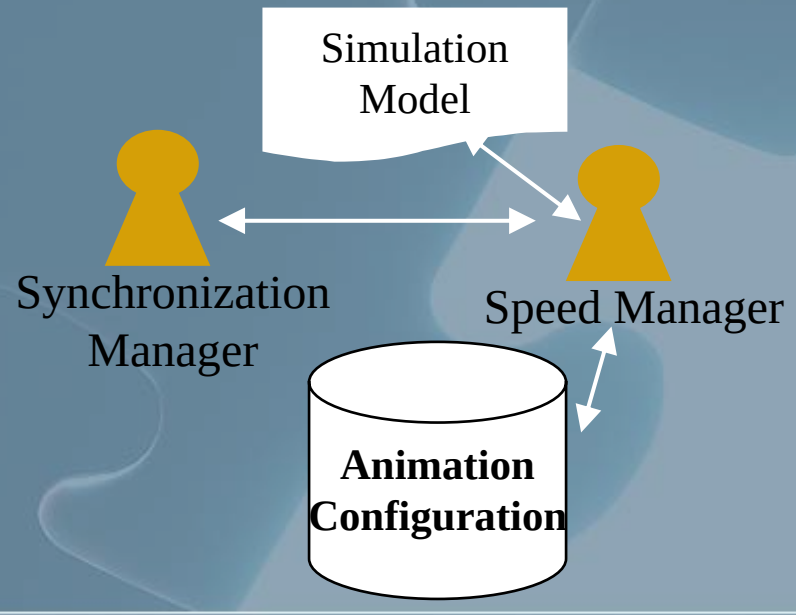
Phase 1: Agents F1b - F1c



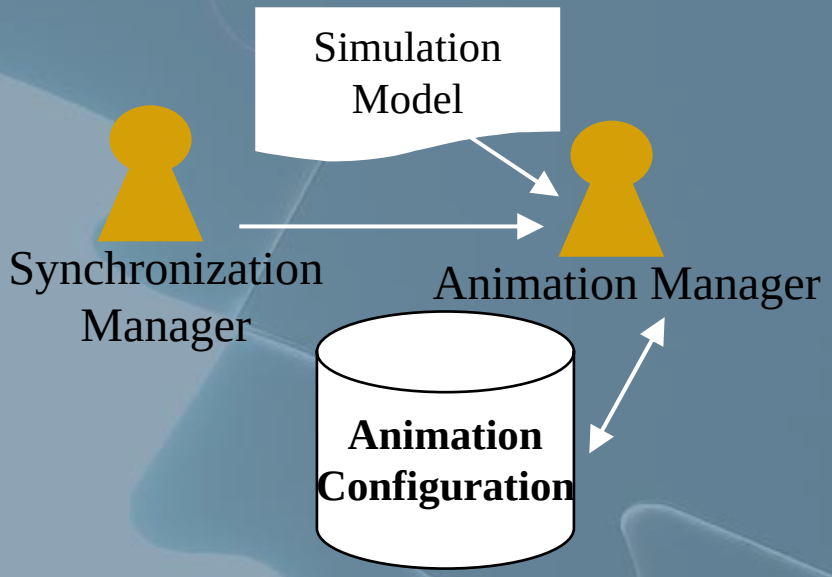
Phase 2: Scenarios - Agents F2a



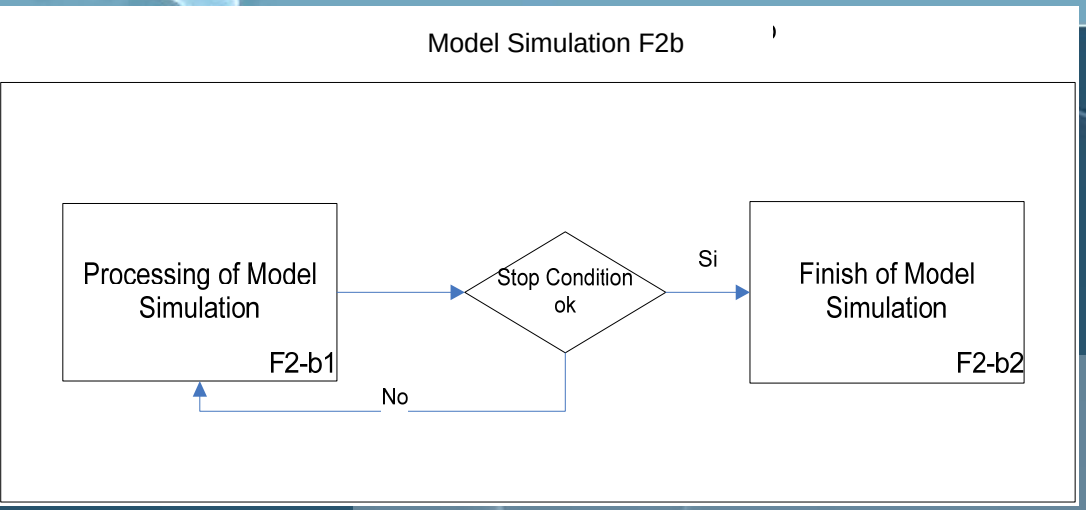
Definition of Simulation Speed F2-a1

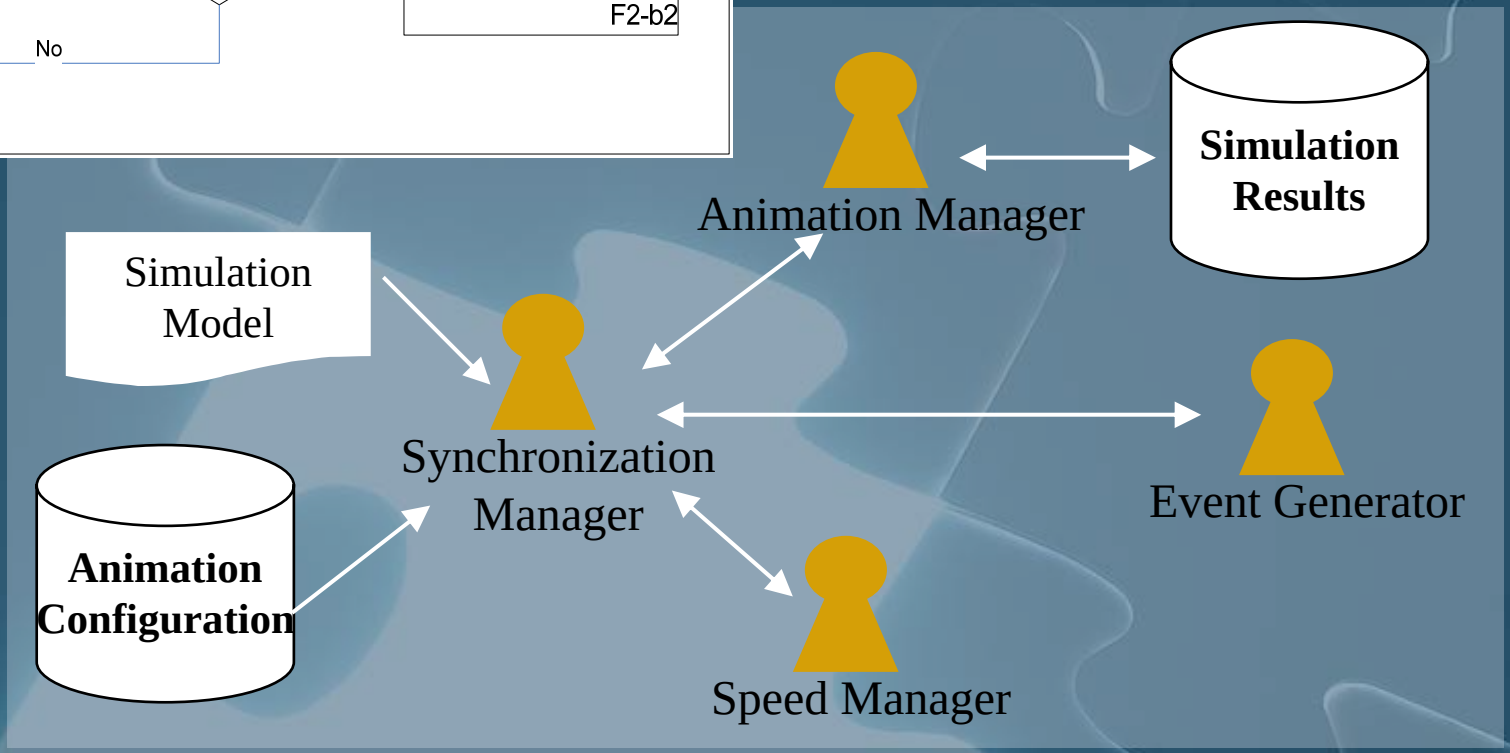


Verification of Animation Element F2-a2



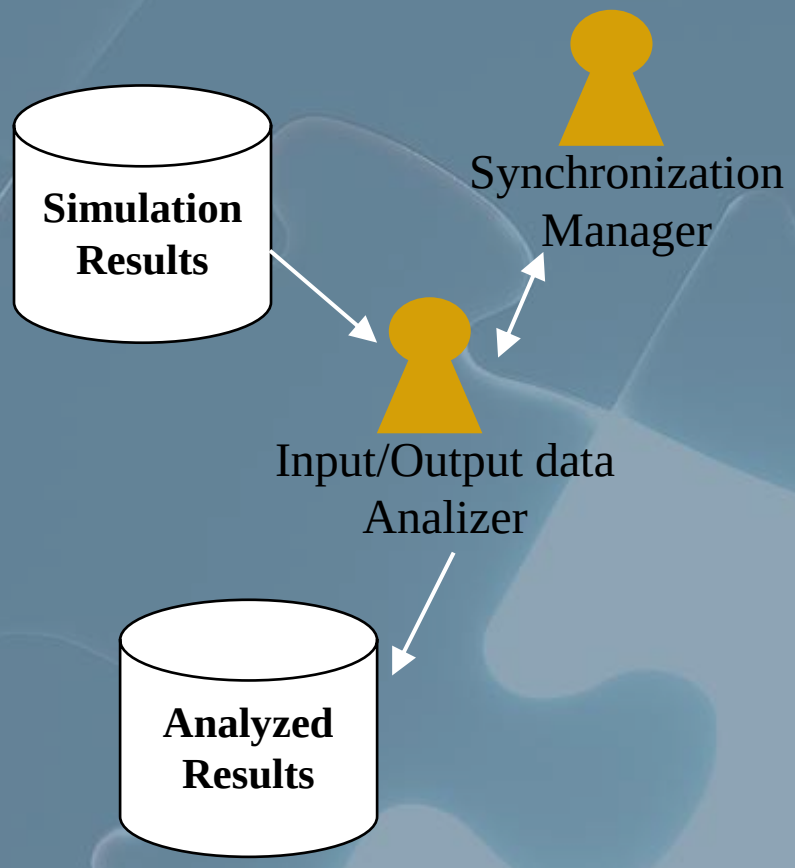
Phase 2: Scenarios - Agents F2b



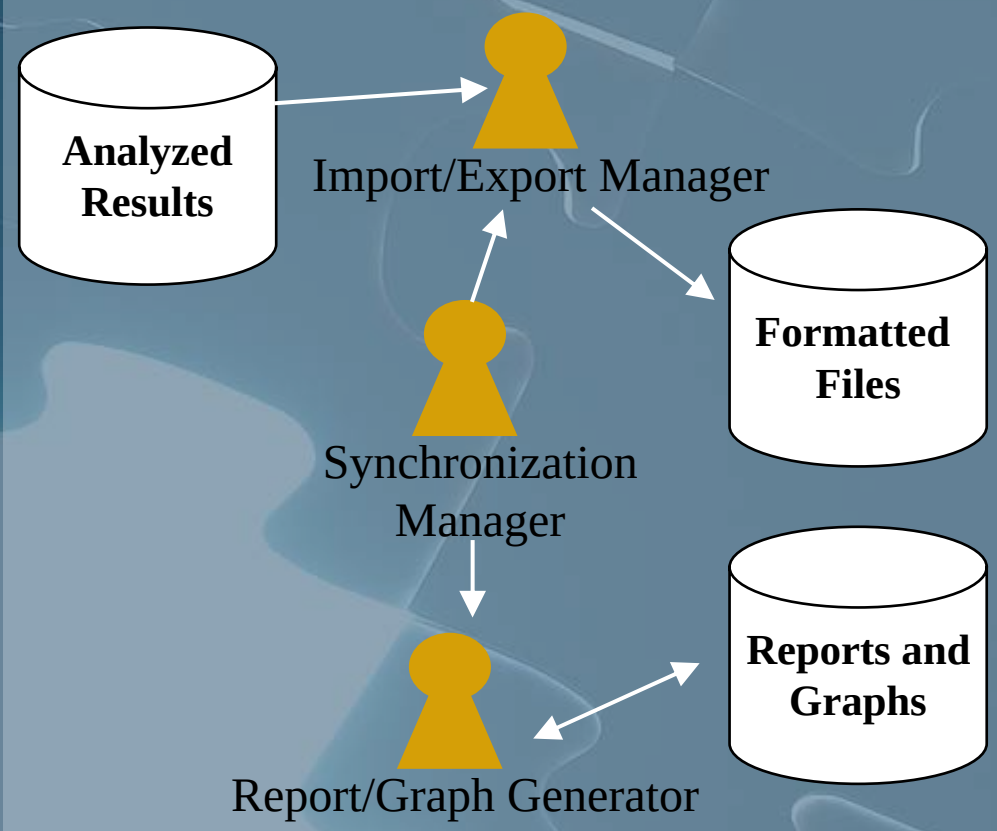


Phase 2: Agents F2c – F2e

Analysis of Simulation Results F2-c



Reports and Graphs Generation F2-e



Conclusions

Based on:

- the new manufacturing systems requirements;
- an study of functionalities that offer current simulation tools; and,
- the success of agent-based manufacturing systems modelling

We have proposed an agent-based architecture for a simulation tool for manufacturing systems.

Future Work

- Finish the design phase of the tool using the ANEMONA's methodology (Giret 2005).
- Implementation and validation of the proposed tool.

An Agent-Supported Simulation Architecture for Manufacturing Systems

Thank you for
your attention…

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