

PLEGMA: An Agent-Based Architecture for Developing Network-Centric Information Processing Services

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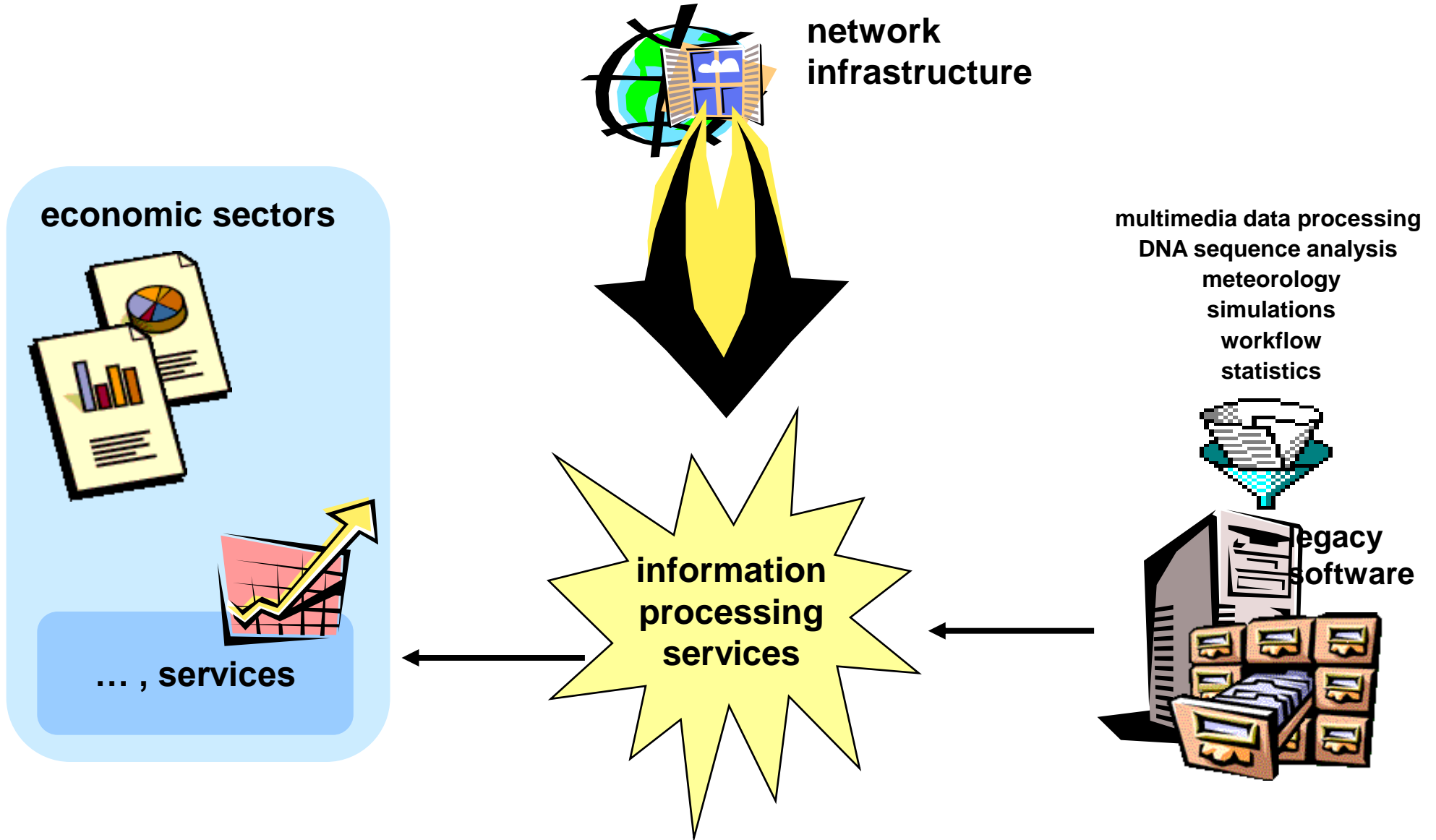
abstract

The current transition from stand-alone systems towards services networks demands that information processing is seamlessly available over large scale distributed environments, where mechanisms of intelligent execution scheduling and charging are required to ensure quality of service and allow providers to automatically determine and dynamically adapt the price of service and cost models to current supply and demand.

This poster describes a market-based, network-centric agent architecture to support integrated information processing services in virtual private networks and extranets. The Plegma architecture is inherently scalable from secure Intranets to large-scale Internet applications.

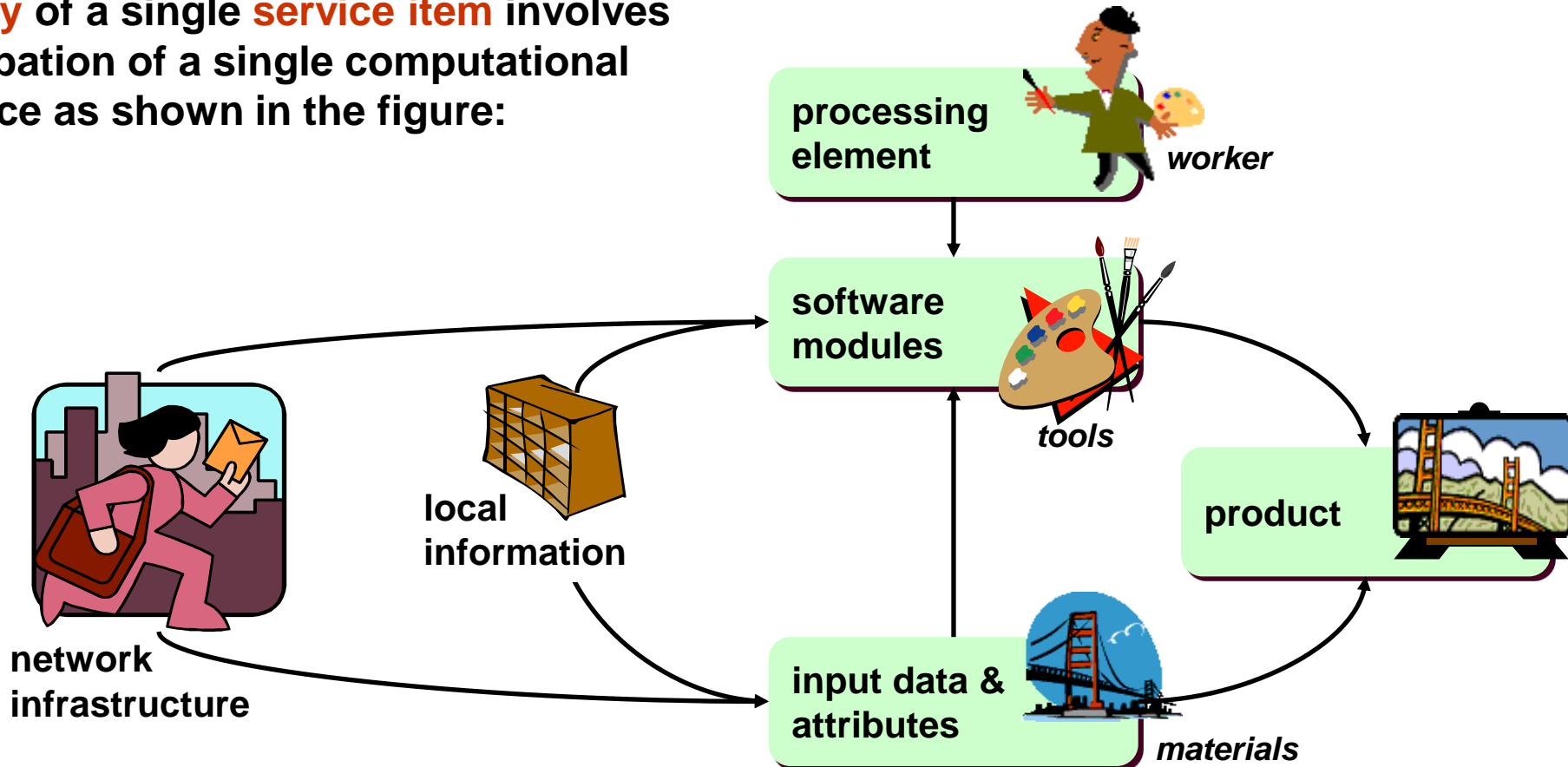
Distributed autonomous agents, responsible for local resources and specific processing methods, collaborate to decompose complex processing tasks and address dynamically the problem of task allocation and charging. The architecture features a market-based resource management mechanism, supports charging and accounting procedures, enhances re-use of legacy software, and supports the formulation of access policy.

information processing services

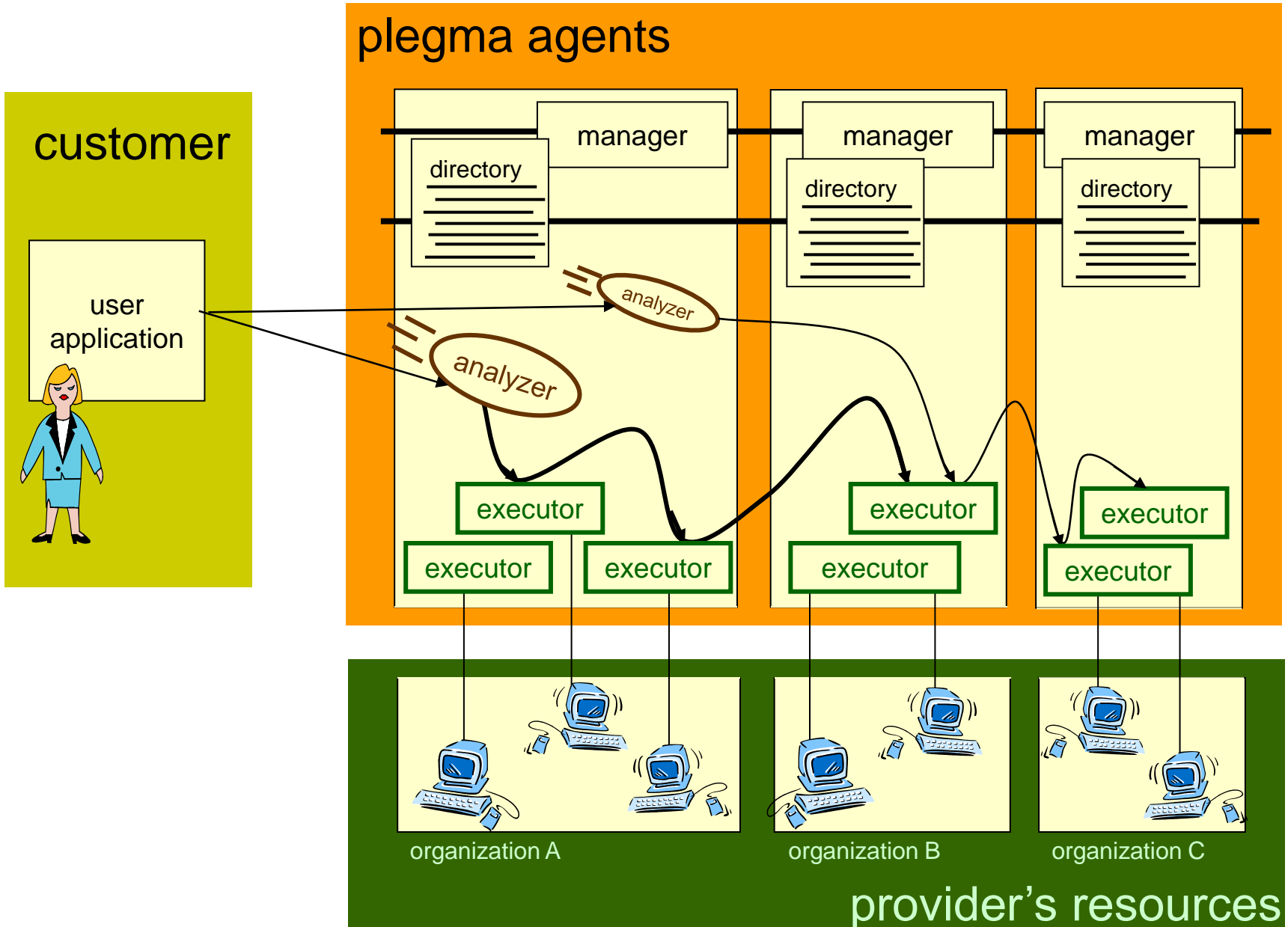


information processing in the digital agora

- ☉ the network of **computational resources** is an electronic marketplace
- ☉ simple processing **service items** are grouped in complex predefined sequences and offered as a **service package**
- ☉ **delivery** of a single **service item** involves participation of a single computational resource as shown in the figure:



PLEGMA architecture



PLEGMA agents

executor

- ❑ manages the local business unit to the best interest of its owner
- ❑ develops the local business plan and pricing policy according to self-evaluation, local policies and current market trends
- ❑ manages the supply feed (input data & software module)
- ❑ ensures competitiveness of services (software repository)
- ❑ arranges product delivery (store-and-forward, proactive signaling)



analyzer



- ❑ customer representative for a particular service package
- ❑ handles the scheduling of a service package
- ❑ manages overall execution of individual tasks, handles negotiations, poses required policies & strategies
- ❑ delivers final product to destination

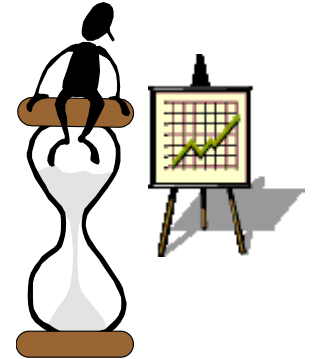
manager

- ❑ like a bank with a network of branches
- ❑ performs accounting and monitors overall credibility of customers and workers
- ❑ broker of the local agora, participating in a network of brokers to cover the global market place



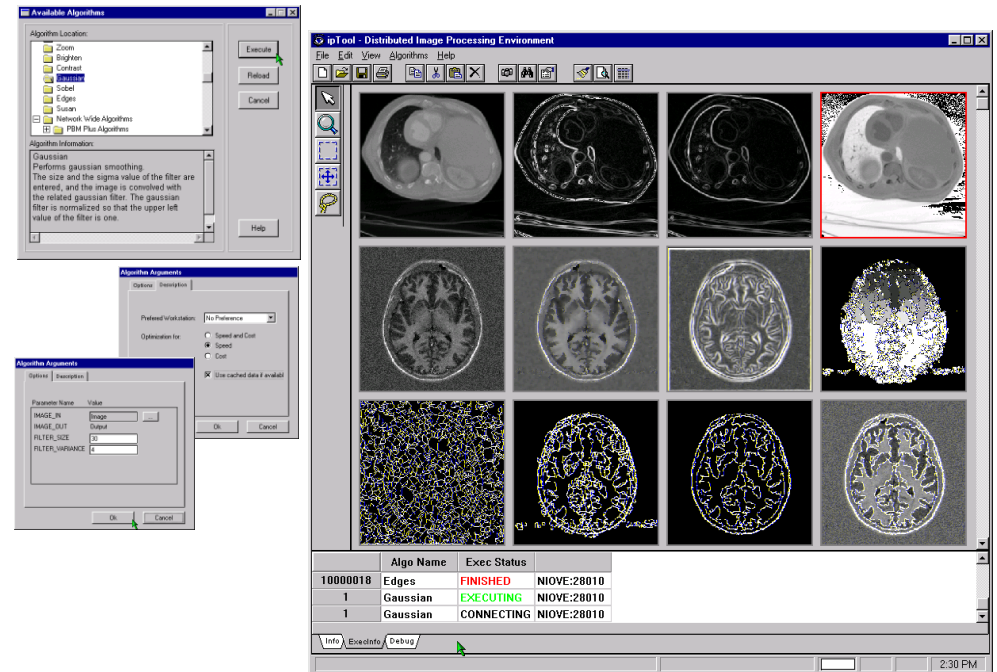
task allocation and charging

- ☉ based on **market metaphor** and realized through negotiation among analyzers and execution agents
- ☉ analyzer initiates an **auction** for the execution of the service package
- ☉ participating execution agents calculate **bids** based solely on local information and desired policies
- ☉ analyzer **grants** execution to the best bidder according to criteria specified by his client or other policies
- ☉ analyzer can choose to grant execution with a **direct contract**, when the cost for bidding is relatively high compared to the cost for the task
- ☉ a **simulator** is used to test each market model & auction process, thus aiding in formulating the desired policy



DIPE - image processing services

- ✓ distributed execution of image processing algorithms
- ✓ plug-n-play insertion of third-party image processing software
- ✓ software development, testing, & evaluation
- ✓ construction & processing of macros
- ✓ intelligent mechanisms for computational resource management
- ✓ integration with other services & systems



■ C++, UNIX & Windows 95/NT

■ zApp - graphical user interface transparency

■ ACE - operating system transparency, network transparency

■ CORBA - integration

WOPE - dynamic workflow processing

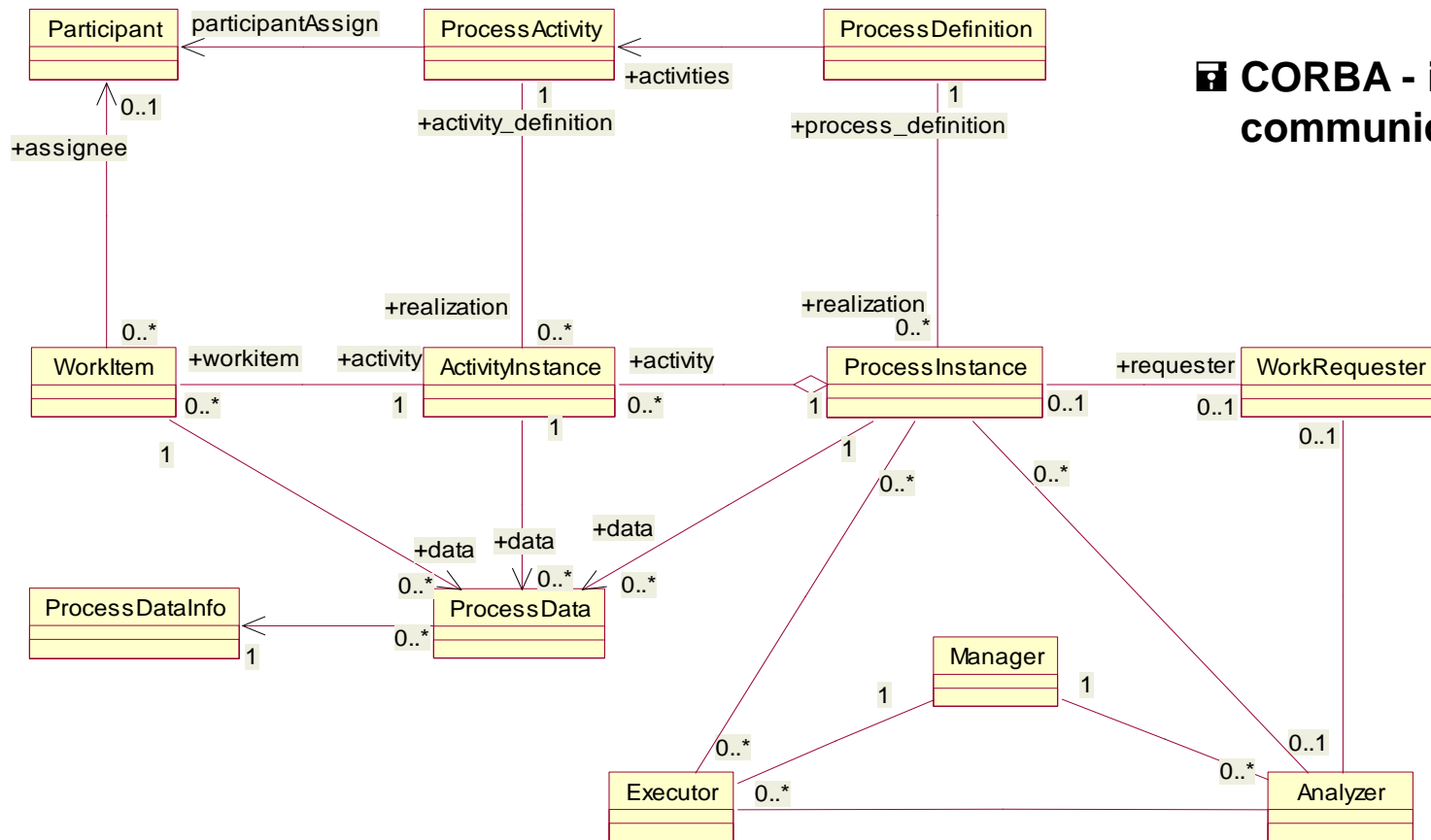
☯ dynamic workflow processing for functional integration in regional healthcare service networks

☑ Java - environment transparency

☑ XML - data integration, workflow specification

☑ WfMC standard compliance

☑ CORBA - integration, communication



conclusions

potential applications

- ☯ best use of computational resources & quality of service
- ☯ integration of heterogeneous algorithms, and software/hardware platforms
- ☯ 'renting' processing algorithms and resources
- ☯ processing services within a 'virtual' enterprise
- ☯ added value service over various information services networks

current work

- 📁 use the architecture and the implemented environments as a testbed for studying different negotiation mechanisms for provider's and customer's planning policies
- 📁 develop mechanisms for dynamically adapting pricing and allocation based on demand trends
- 📁 develop a framework for constructing PLEGMA based environments

