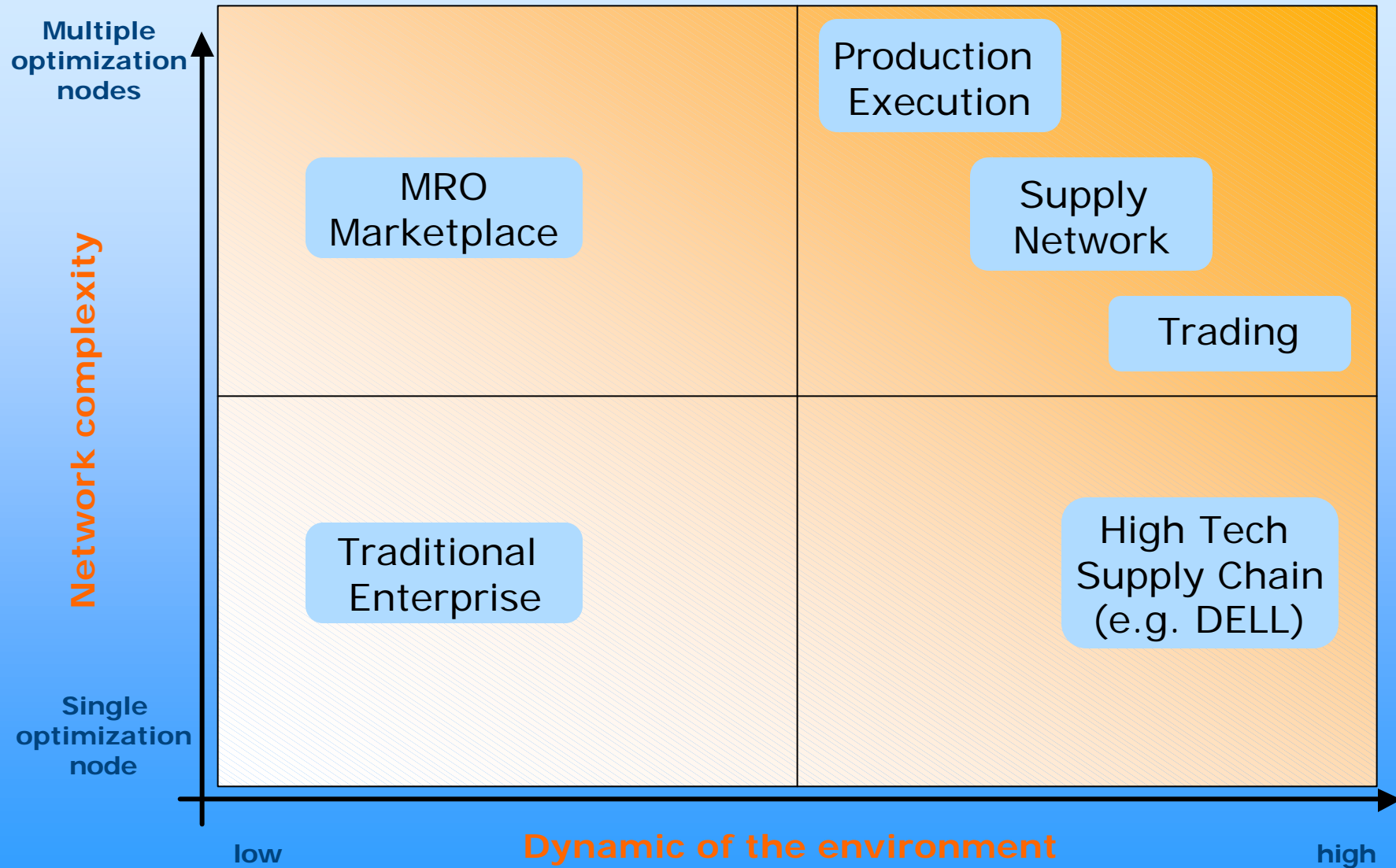# living markets

Industrial and commercial

applications of agents

FIPA Conference

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Adaptive Execution

in

Business Networks

Business Networks

are

complex & dynamic

Adaptive Profit Optimization Space

living systems®
transforming markets

Multiple optimization nodes

Network complexity

Single optimization node

MRO Marketplace

Production Execution

Supply Network

Trading

Traditional Enterprise

High Tech Supply Chain (e.g. DELL)

low

Dynamic of the environment

Adaptive Execution in Business Networks

living markets

Industrial and commercial

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Our solutions for logistics and finance are based on following products:

- living markets Base
- living markets ATN (**A**daptive **T**ransportation **N**etworks)
- living markets ASN (**A**daptive **S**upply **N**etworks)
- living markets APN (**A**daptive **P**roduction **N**etworks)
- living markets AEN (**A**daptive **E**nergy **N**etworks)
- living markets OTC (**O**ver **T**he **C**ounter)
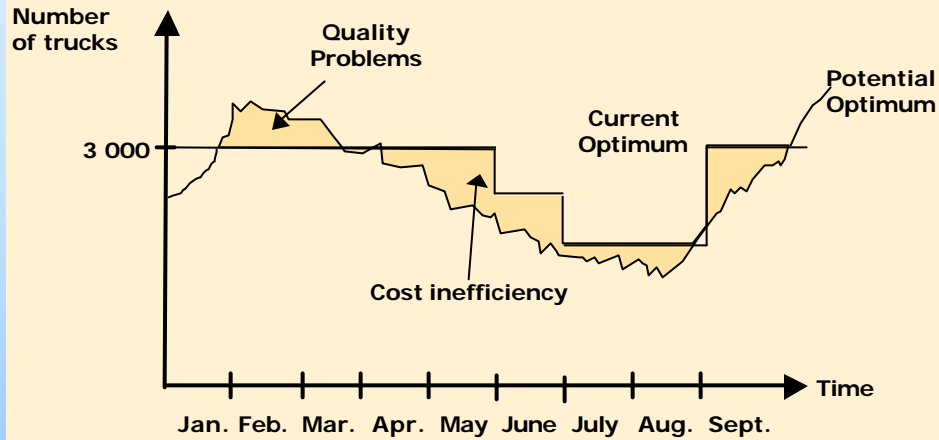- living markets Portal

living markets

Industrial and commercial applications of agents

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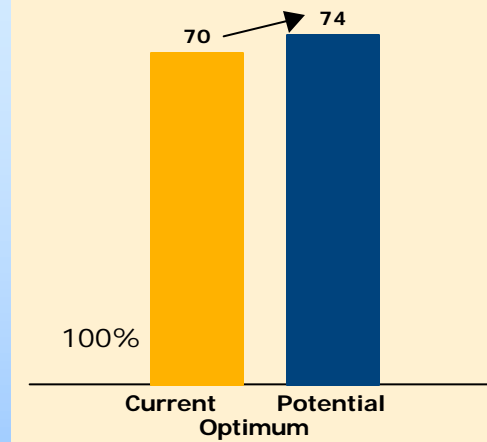
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Real-time Adaptive Execution could lead to significant bottom-line impact in groupage networks
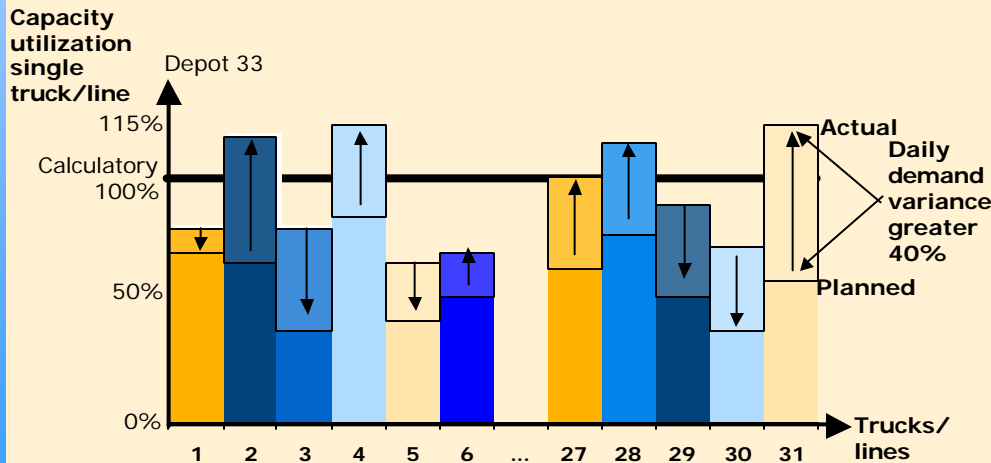
living systems®
transforming markets

Monthly Network Capacity Planning

Number of trucks

Quality Problems

Potential Optimum

Current Optimum

3 000

Cost inefficiency

Time

Jan. Feb. Mar. Apr. May June July Aug. Sept.

Daily Capacity Utilization Planned vs. Actual

Capacity utilization single truck/line

Depot 33

115%

Calculatory 100%

50%

0%

1 2 3 4 5 6 ... 27 28 29 30 31

Trucks/lines

Actual

Daily demand variance greater 40%

Planned

Example: Capacity Utilization in %

70

74

100%

Current Optimum

Potential Optimum

Example: Return on Sales in %

4

2

Current Optimum

Potential Optimum

Example: 4% points improvement of capacity utilization yields 100% improvement of ROS

Adaptive Execution in Business Networks

Execution On Top Of Planning

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transforming markets

Processes

ROS

Automation & Optimization Real-time

living markets ATN

- Capacity Optimizer
- Capacity Procurement
- Yield Optimizer

Capacity Utilization in %

+4

Additional Actual Utilization

ROS in %

+2

Additional Actual ROS

+6%

Additional AET Solution Value

+100%

Operational 1d < 1 month

Order Fulfillment

- Order Mgmt.
- Transport Planning & Execution
- Terminal Operations
- International Trade & Shipment
- Audit & Freight Settlement

Support Processes, e.g. Accounting

70

Tactical 1–18 months

- DSP and Matching
- Logistics Capacity Planning
- Transportation Asset Mgmt.
- Carrier Procurement

2

Strategic > 36 months

- Supply Chain Strategy
- Logistics & Network Strategy
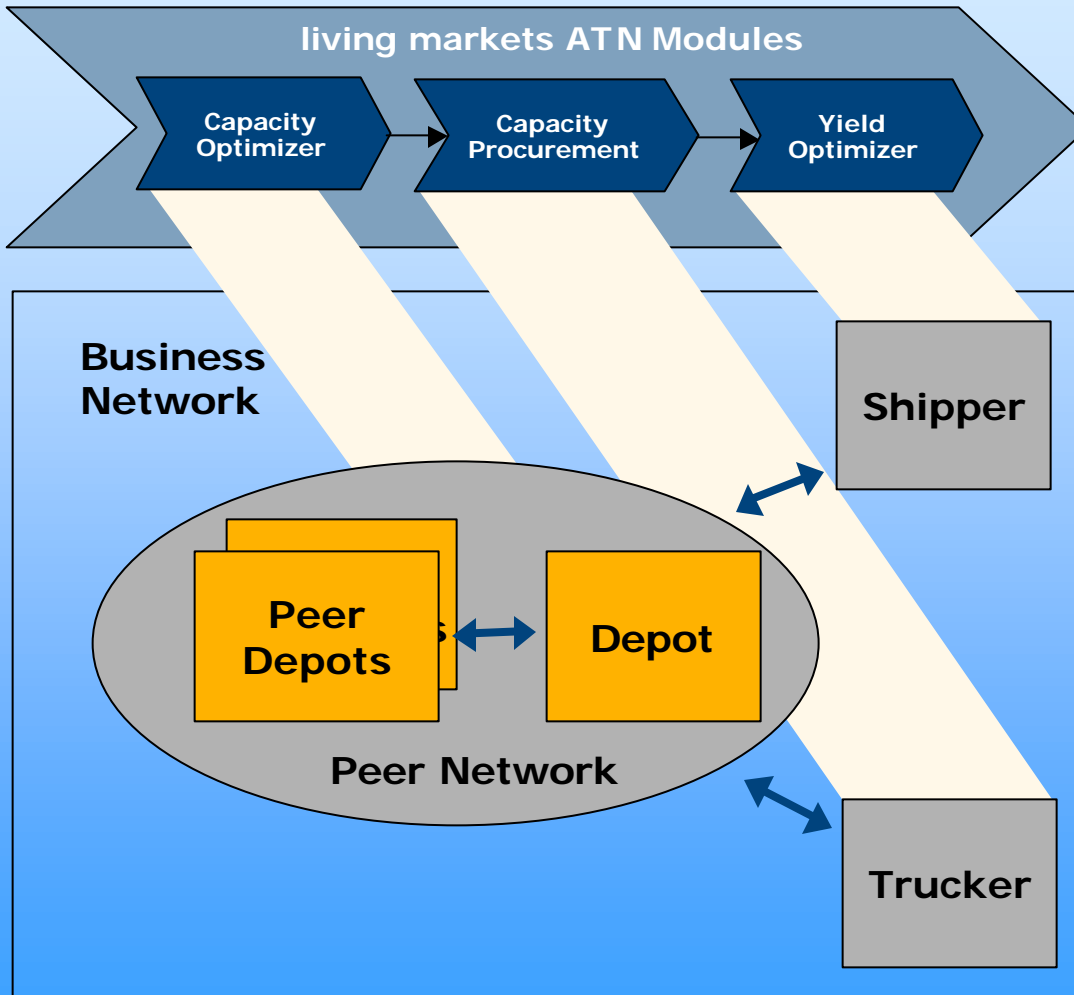- Business Strategy

Planned Utilization

Planned ROS

Legend:
- Adaptive Execution
- Pure Logistics Processes
- DSP and Matching & other SC Processes outside logistics
- Support Processes

Adaptive Execution in Business Networks

living markets ATN consists of three modules

living markets ATE SOLUTION SUITE

living markets ATN Modules

Capacity Optimizer → Capacity Procurement → Yield Optimizer

Business Network

Shipper

Peer Depots ↔ Depot

Peer Network

Trucker

Capacity Optimizer
- Identifies network options
- Prioritizes best options
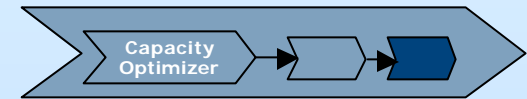- Deviation Implementation

Capacity Procurement
- Online auctions for capacity
- E-procurement
- Security

Yield Optimizer
- Gives automated price quotes
- Supply-side driven yield management

SOLUTION MODULE CAPACITY OPTIMIZER

Capacity
Optimizer

Control Center

| Relation	Category	Cost	Depart. CG	Arrival ST	Capacity Mismatch
Duisburg – Köln – Stuttgart	Give	370	21:00	3:30	-2%
Köln – Koblenz – Stuttgart	Take	410	19:00	3:00	-20%
Köln – Frankfurt - Stuttgart	Take	490	19:00	3:00	-26%
Köln - Stuttgart	Direct	800	19:00	1:30	-44%

- Interface for human intervention
  - Rejection/acceptance of options
- Displays Key Performance Indicators (KPIs) and preferred options
  - Adjustment of goal parameters

1. Event Monitor

Depot 33			
Tomorrow			
Today			

| Destin.	Total Capacity	Utilized Capacity	Capacity Mismatch
A	40	18	-44%
B	40	37	-8%
C	20	14	-30%
D	40	47	+18%
E	10	13	+30%

- Collects demand/supply data from different sources
  - Scheduling Plan
  - Customer orders
- Identifies optimization opportunities/mismatches

2. Options Finder

4. Level
3. Level
2. Level
1.
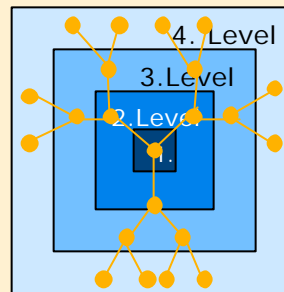
Real-time optimization is subject to
- Time/quality restrictions
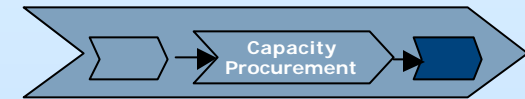- Process cost (indirect transports)
- Cancellation cost
- External options

3. Deviation Implementation

Depot 33

115%
100%
50%
0%

1 2 3 4 5 6 ... 27 28 29 30 31

Trucks/ lines
Truck
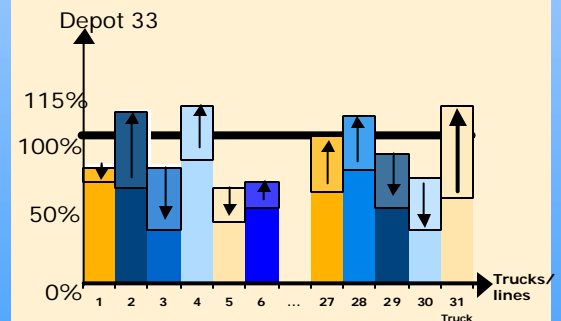
- Automatic plan change
  - Scheduling trucks
  - Capacity planning terminals
- Automatic market actions
  - RFQ trucker
  - Cancellation

SOLUTION MODULE CAPACITY PROCUREMENT

Capacity
Procurement

Capacity Procurement

- Carrier registration
- Filtering of carriers
- Soft and hard capacity matching and parallel offering
- Quality/price rating
- Contracting

Business Benefits
- Reduction of process cost (up to 80%)
- Better price transparency/price reductions (up to 10%)
- Better capacity utilization through
  - Internal capacity trading
  - Increased use of short-term booking

1. Spot Buy

- Short-term booking of trucking capacity
- Trucker registration
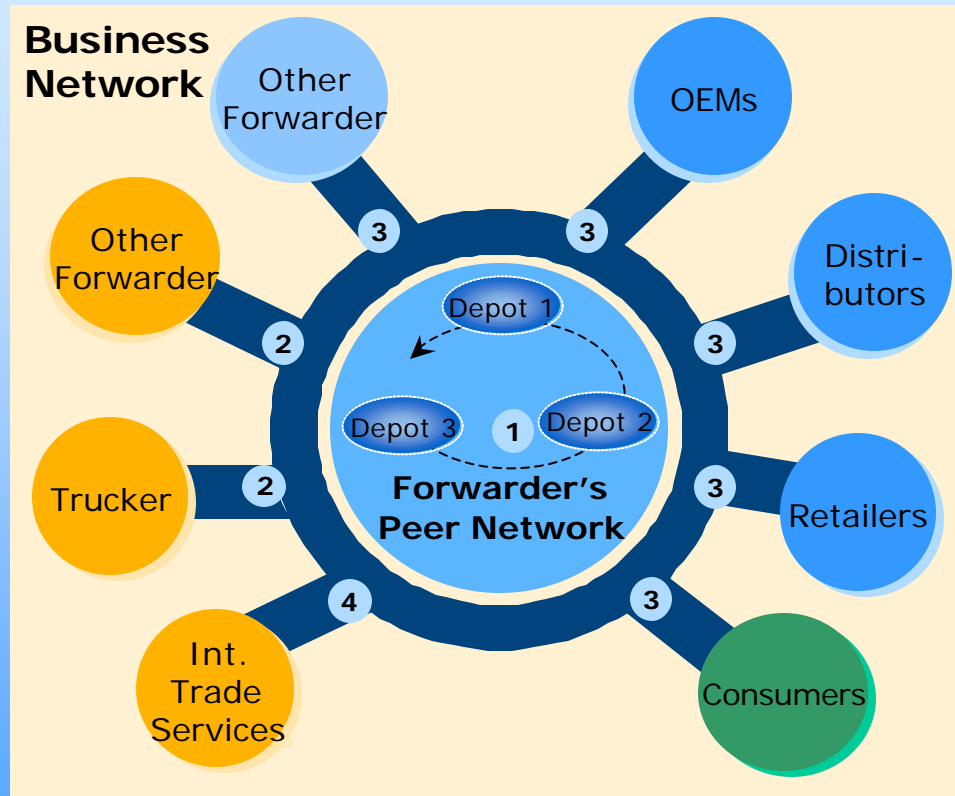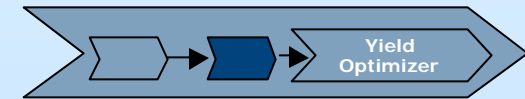- Quality reporting

2. RFQ Processes

- Long-term contracts
- Reverse auction
- Closed bidding mechanism
- Complex network description

3. Communication

- Email
- SMS
- Fax
- EAI:
  - Metadata integration
  - Process integration
 - Java space

Influencing customer demand using ATN

SOLUTION MODULE YIELD OPTIMIZER

Internet-enabled network platform that facilitates information sharing, transactions, and collaboration within and among trading partners to optimize a company's logistics and fulfillment commitments

1 Demand/Supply Matching & Optimization
2 Capacity Procurement
3 Yield Optimizer & Available to Promise (ATP)
4 Bundling of Services

Key benefits of Adaptive Transportation Networks?

living markets ATN Modules

Capacity Optimizer → Capacity Procurement → Yield Optimizer
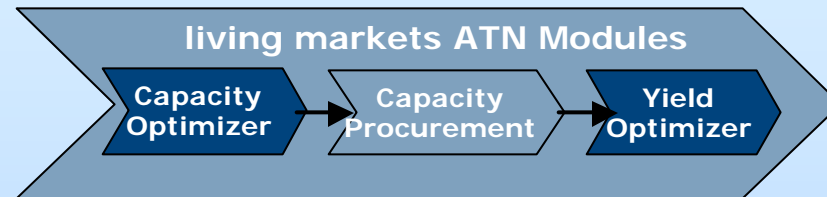
Cost reduction

- Higher capacity utilization

- Internal cost transparency of procured capacity

- Lower process cost

Quality improvement

- Higher on-time delivery performance

- Increased load flexibility

- Flexible adjustment of on-time delivery

Yield improvement

- Instant price & capacity quotation (Available to Promise)

- Dynamic price optimization

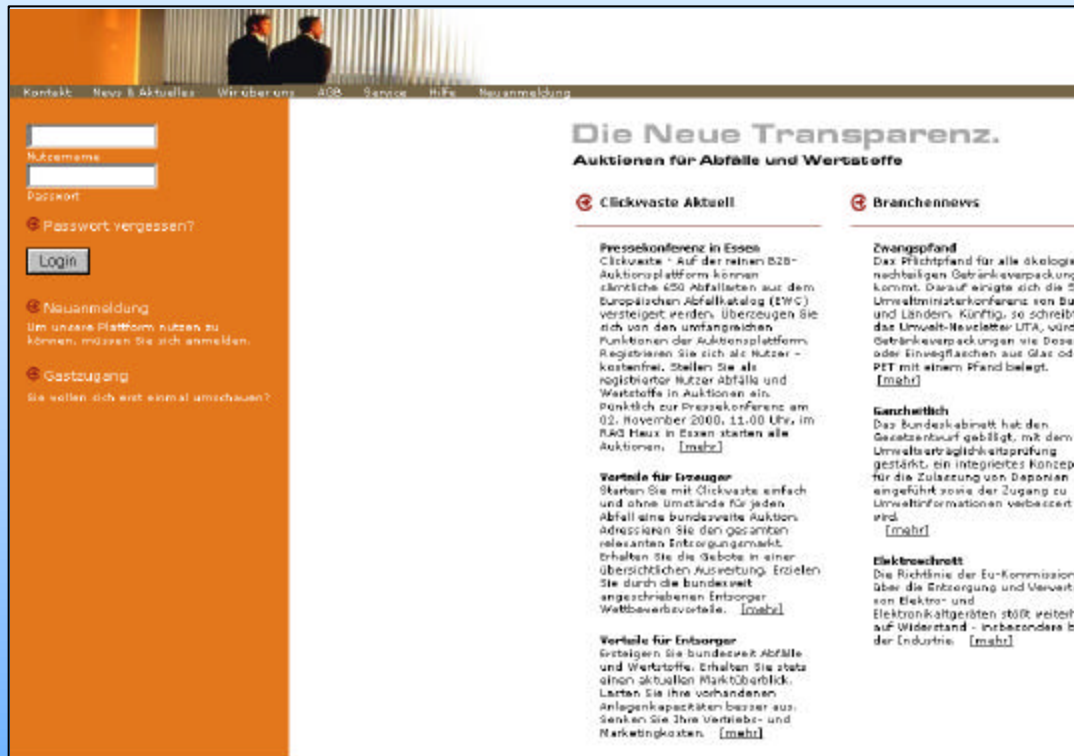- Incremental sales from active market making

living markets

Industrial and commercial

applications of agents

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Clickwaste

living systems®
transforming markets

Clickwaste

- Benefits
  - Reduction of search costs
  - Optimized price allocation
  - accelerated processes

- Web-based process optimization for industrial waste management
- capacity procurement for waste logistics services
- capacity optimization planned for later stage

Reway GmbH/Gothaer Rückversicherung AG
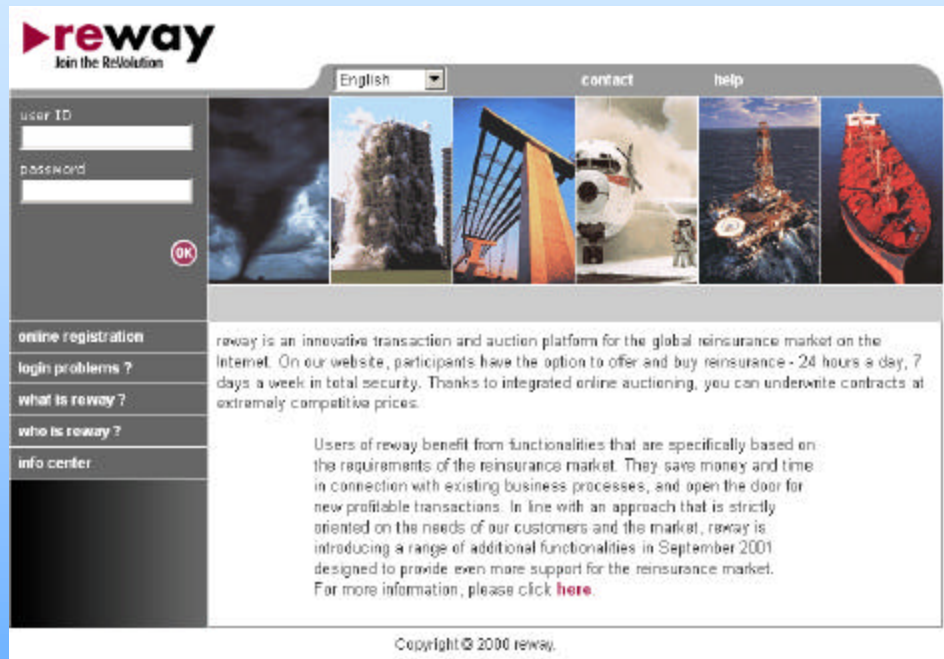
- Benefits
  - Reduction of transaction costs
  - Optimized capacity and price allocation
  - Competitive advantage

An e-commerce platform for the global reinsurance market: primary insurers place risks and re-insurers can bid simultaneously within a specified bid time.

living markets

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living systems®

real world mapping
(abstraction level)

role/goal oriented   agents

object oriented   C++, Java

function oriented   3GL, C, Pascal, ...

command oriented   2GL, Assembler

time

Adaptive Execution in Business Networks

Agent Oriented Design
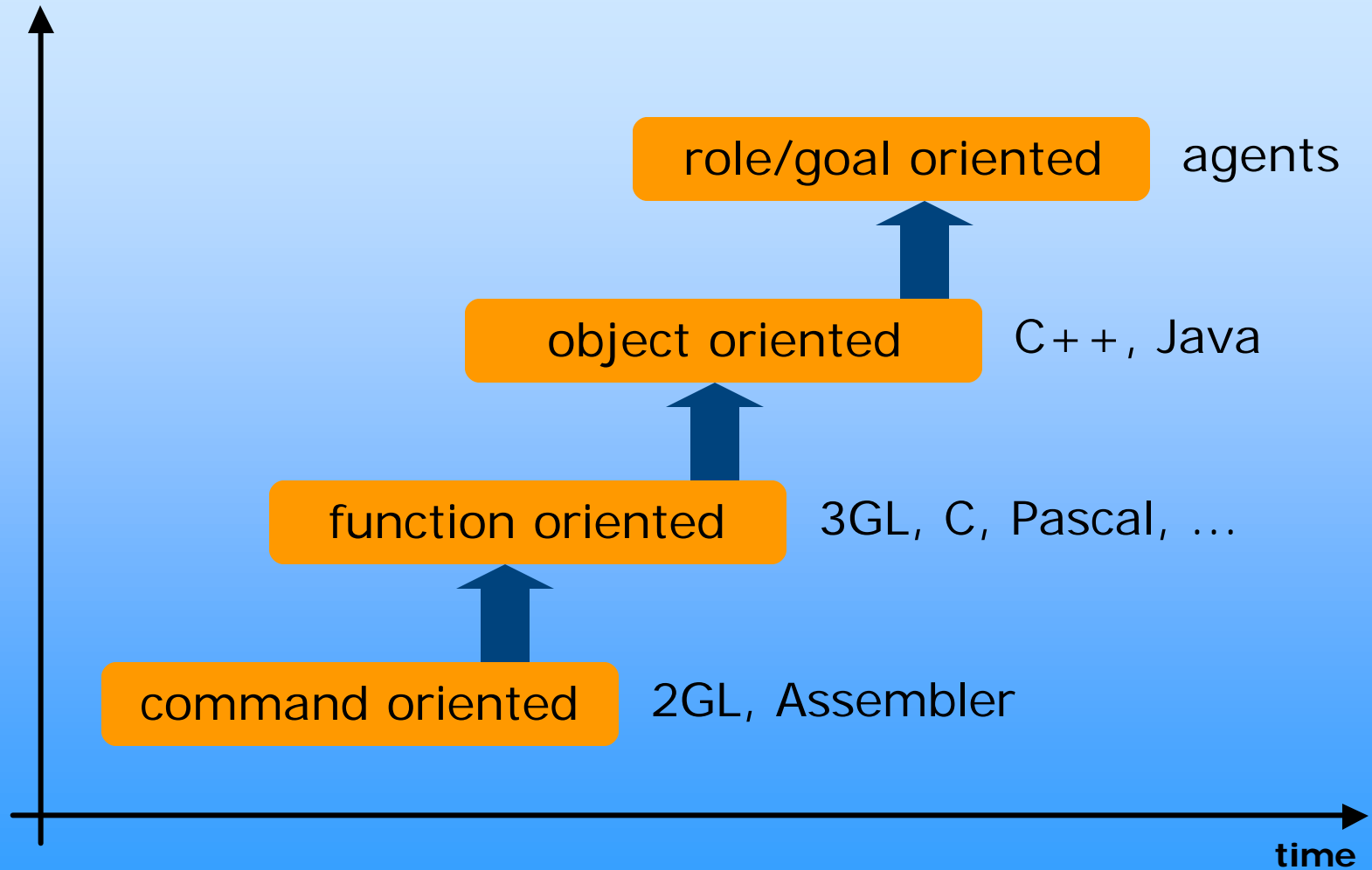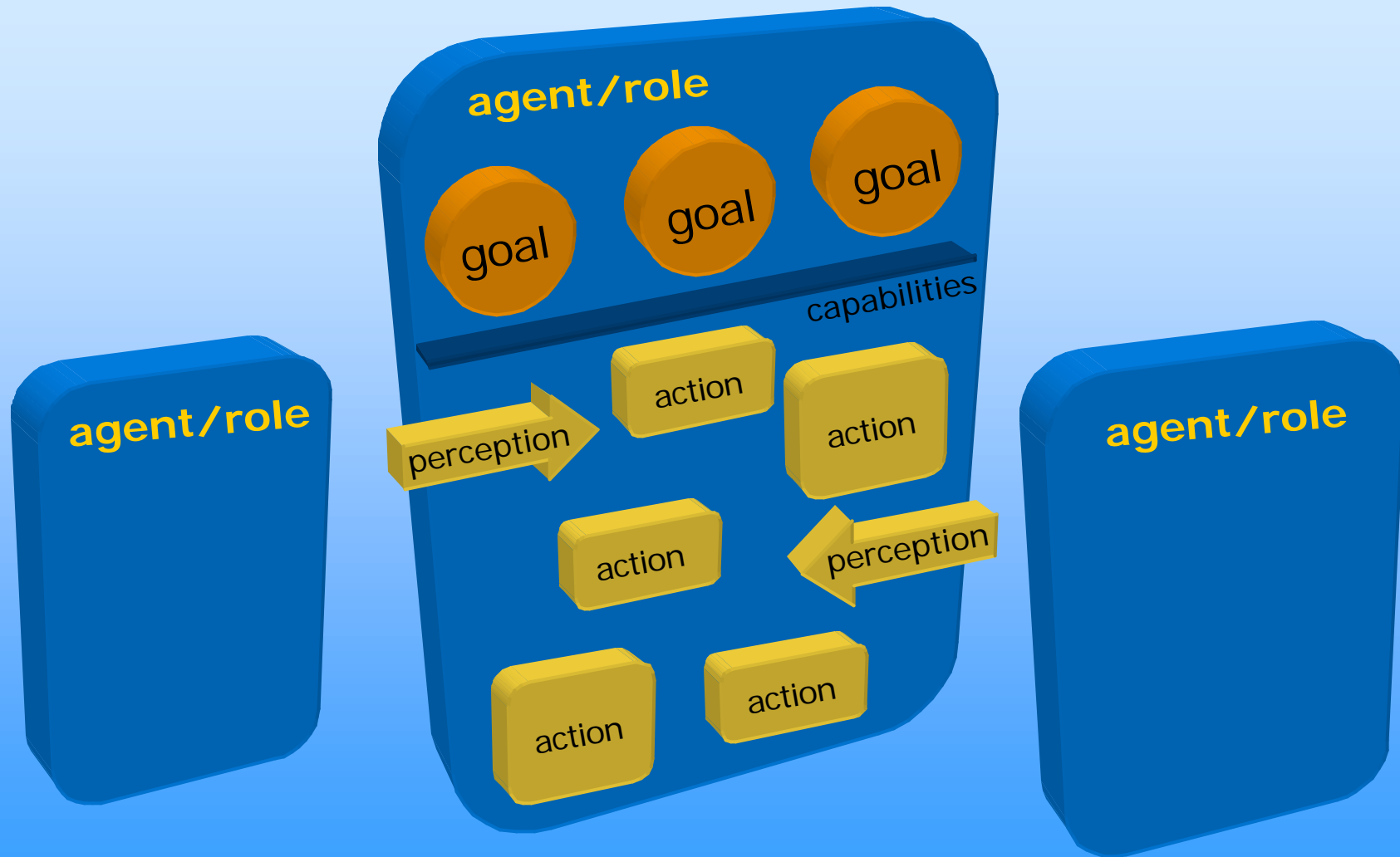
„Software objects that proactively operate on behalf of their human masters in pursuing delegated goals."

- **multi-agent environment**
  - 22 agents

- **heterogeneous agents**
  - goalie, defender, …
  - slow-fast, inert-agile,…

- **adversarial agents**
  - opponent team

- **demanding environment**
  - dynamic, non-deterministic, continuous

- **autonomy**
  - agents play the game without human interference

- **goal-oriented collaboration**
  - offside trap

- **robustness in changing environment**
  - drop out of a player is covered by other players without explicit programming
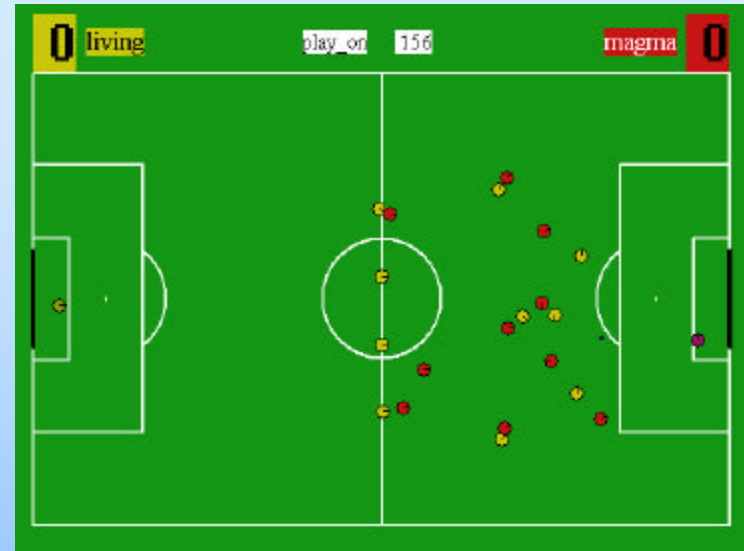
One rule of the defender's strategy:

```
if ballKickable
and lowStamina
then kickAwayBall
effect not ballKickable 0.9
and teammateHasBall 0.5
using leg 1
endif
```
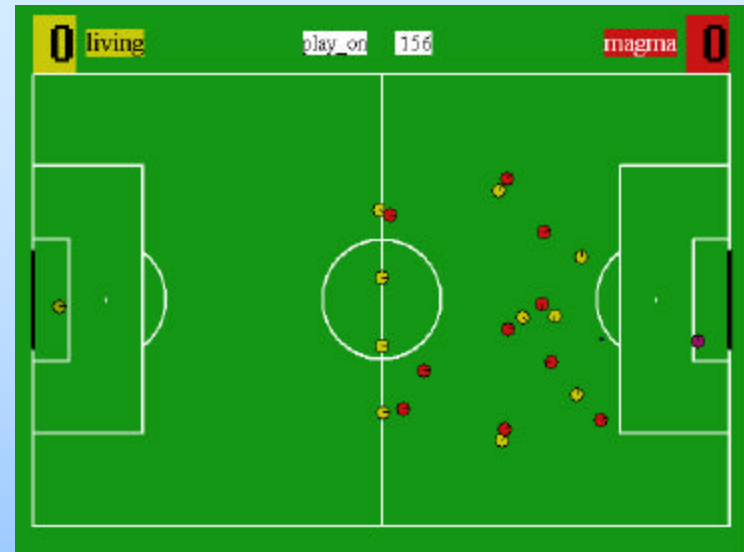
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living systems®
t r a n s f o r m i n g   m a r k e t s

living agents structure

file system

data-base

persistence layer

business logic

XML object → XML object

Message inbox

standard logic

XML

encryption / decryption

communication

XML

<sender>	<receiver>
<subject>	<reply-id>
<content> any XML object </content>	

<sender>	<receiver>
<subject>	<reply-id>
<content> any XML object </content>	
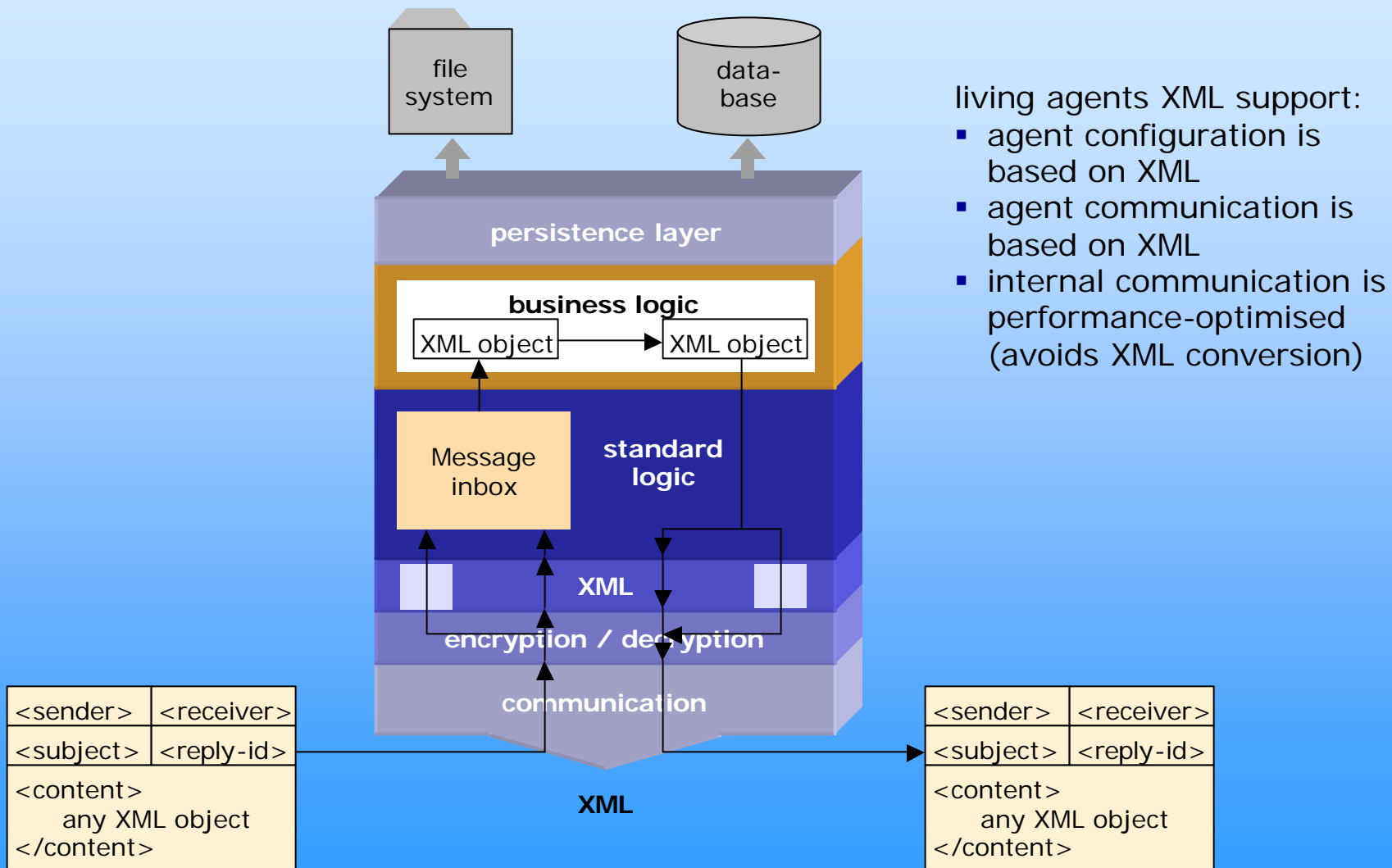
living agents XML support:
- agent configuration is based on XML
- agent communication is based on XML
- internal communication is performance-optimised (avoids XML conversion)

Adaptive Execution in Business Networks   25

Agent Server Architecture

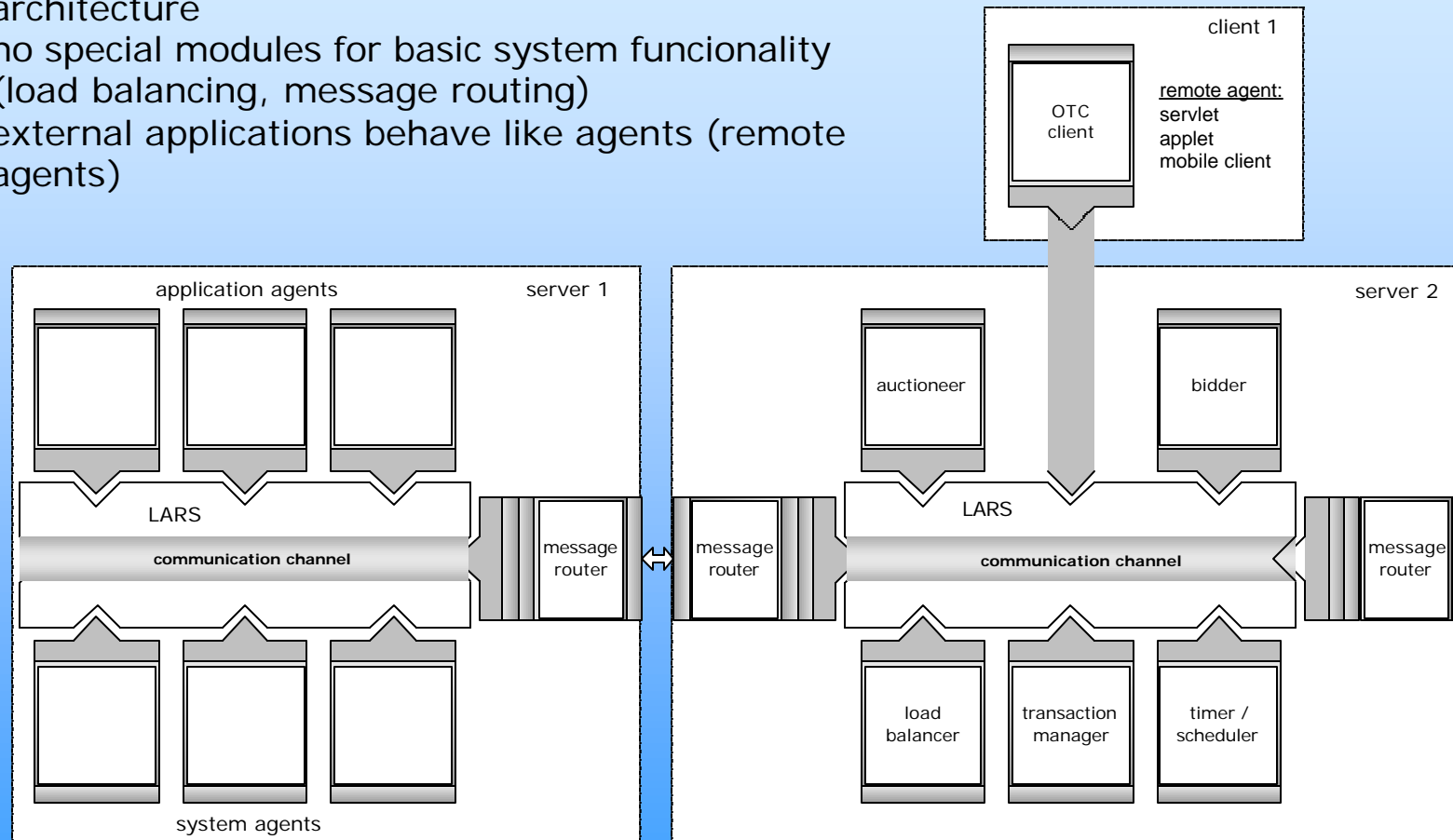- system and application agents based on same architecture
- no special modules for basic system funcionality (load balancing, message routing)
- external applications behave like agents (remote agents)

client 1

OTC client

remote agent:
servlet
applet
mobile client

application agents   server 1

LARS

communication channel

message router

system agents

message router

auctioneer   bidder

LARS

communication channel   server 2

message router

load balancer   transaction manager   timer / scheduler

living markets Scalability
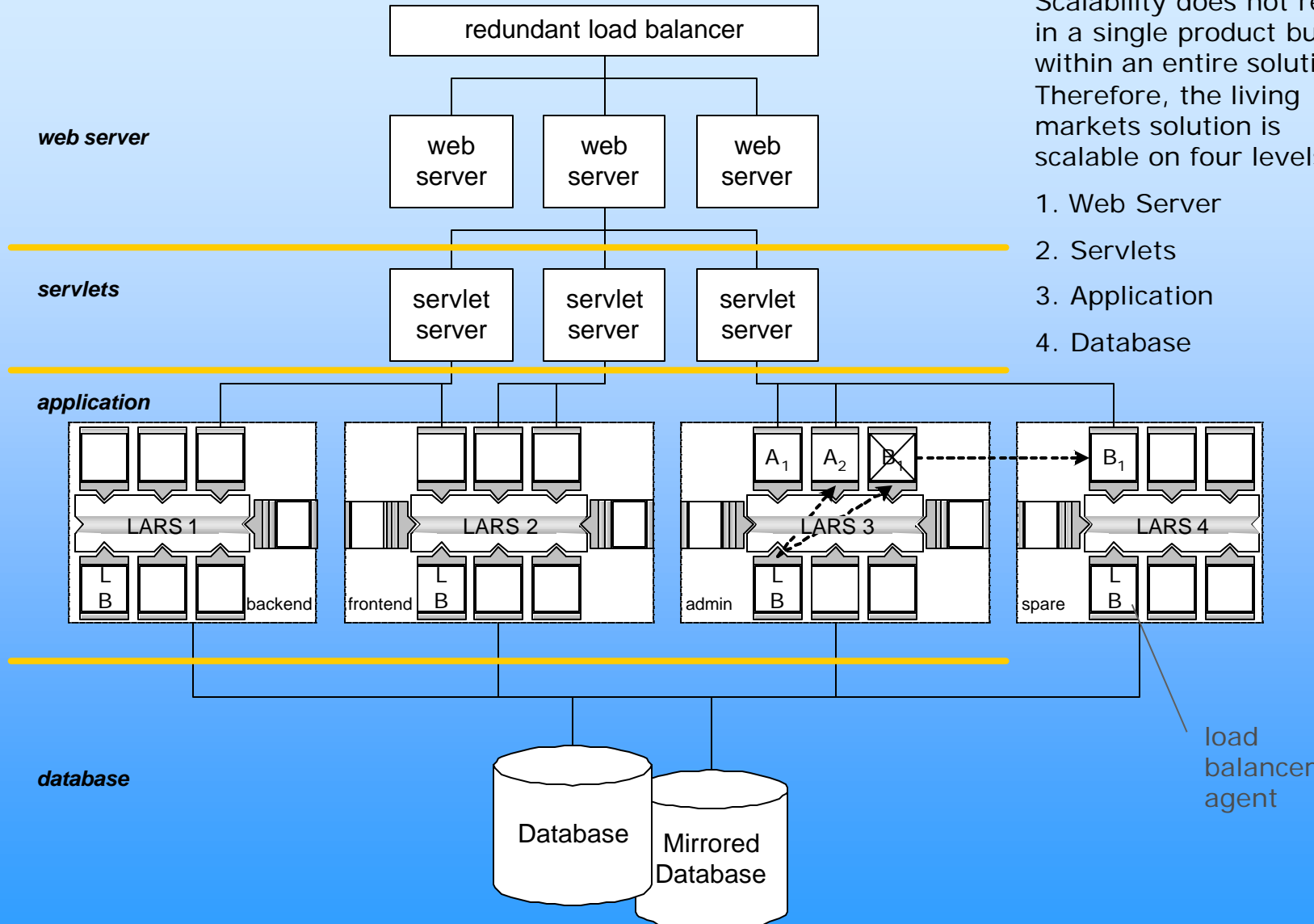
Scalability does not reside in a single product but within an entire solution. Therefore, the living markets solution is scalable on four levels:

1. Web Server
2. Servlets
3. Application
4. Database

redundant load balancer

web server

web server | web server | web server

servlets

servlet server | servlet server | servlet server

application

LARS 1 — LARS 2 — LARS 3 — LARS 4

A_1 A_2 B_1 → B_1

L B | backend | frontend | L B | admin | L B | spare | L B

load balancer agent

database

Database | Mirrored Database

living markets Configuration Flexibility

computer system

LARS

computer system

LARS

LARS

LARS

- one application may run on one or many systems

computer system

LARS

living markets II

computer system

LARS

LARS
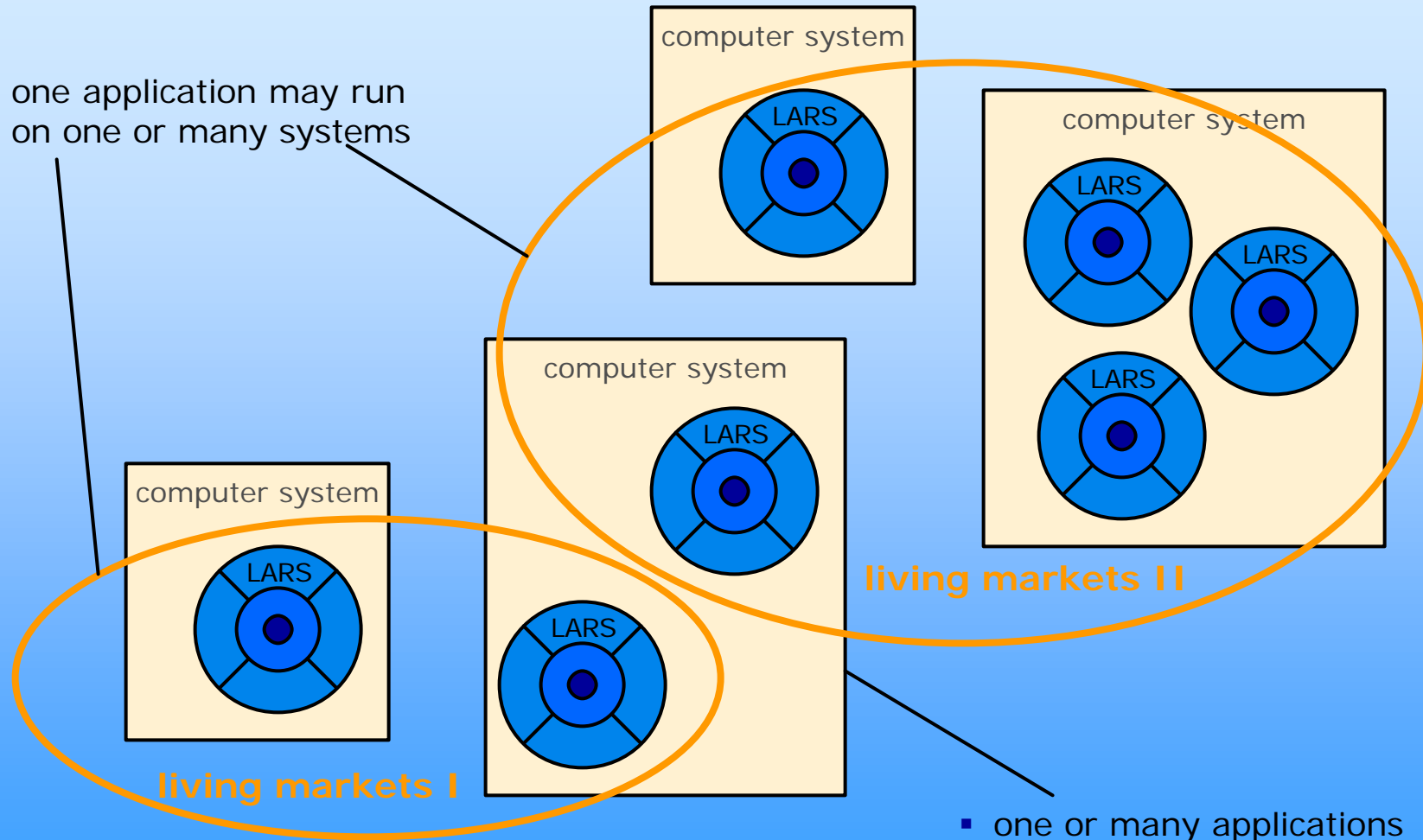
living markets I

- one or many applications may run on one system

LARS: living agents runtime system, the agent server

J2EE application server

living markets

| web server | user interface | JSP |

agents

capabilities

EJB

| JDBC | database | JTA/JTS |

| Java Mail | living agents | JMS |
| RMI | | Corba |
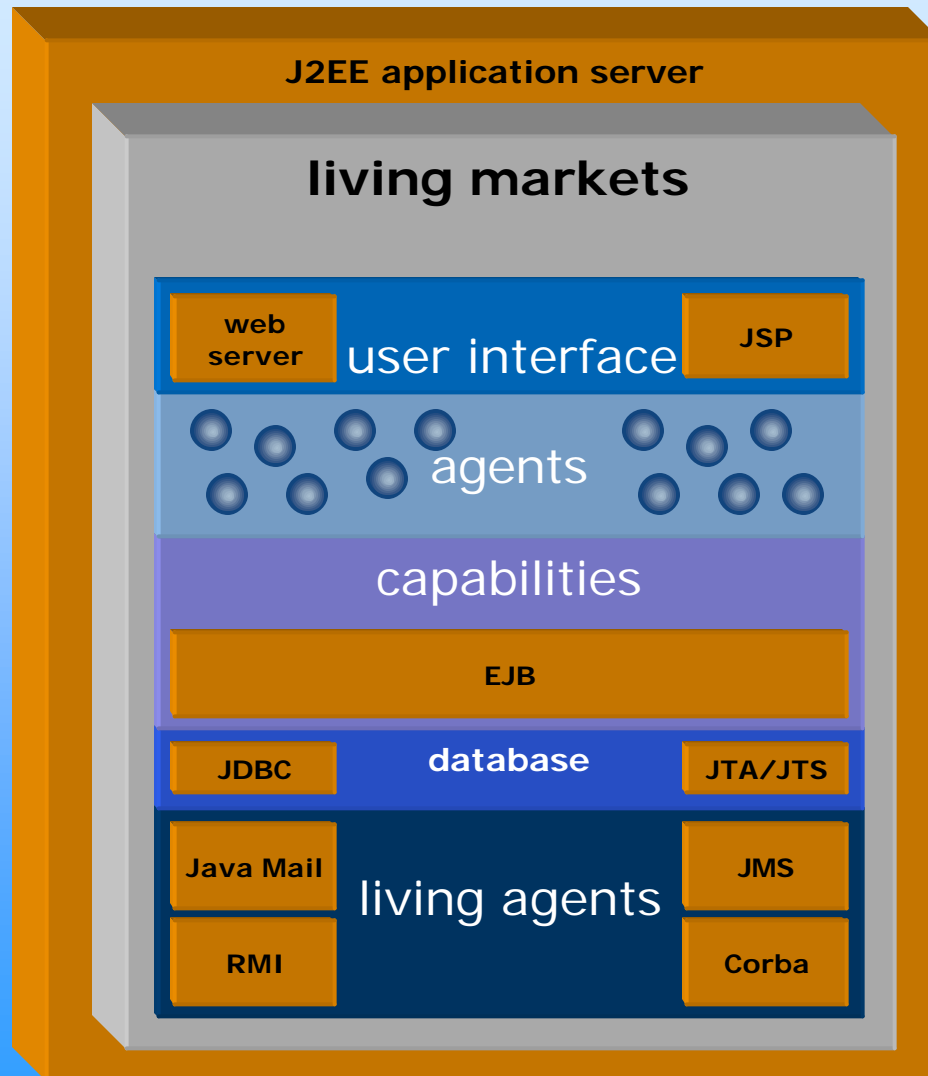
- living markets supports, or enables all established industry standard

- J2EE and its sub-components are one of them

- technology standards allow to interface with any 3rd party system

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living markets
solution platform

logistics

living markets ATN
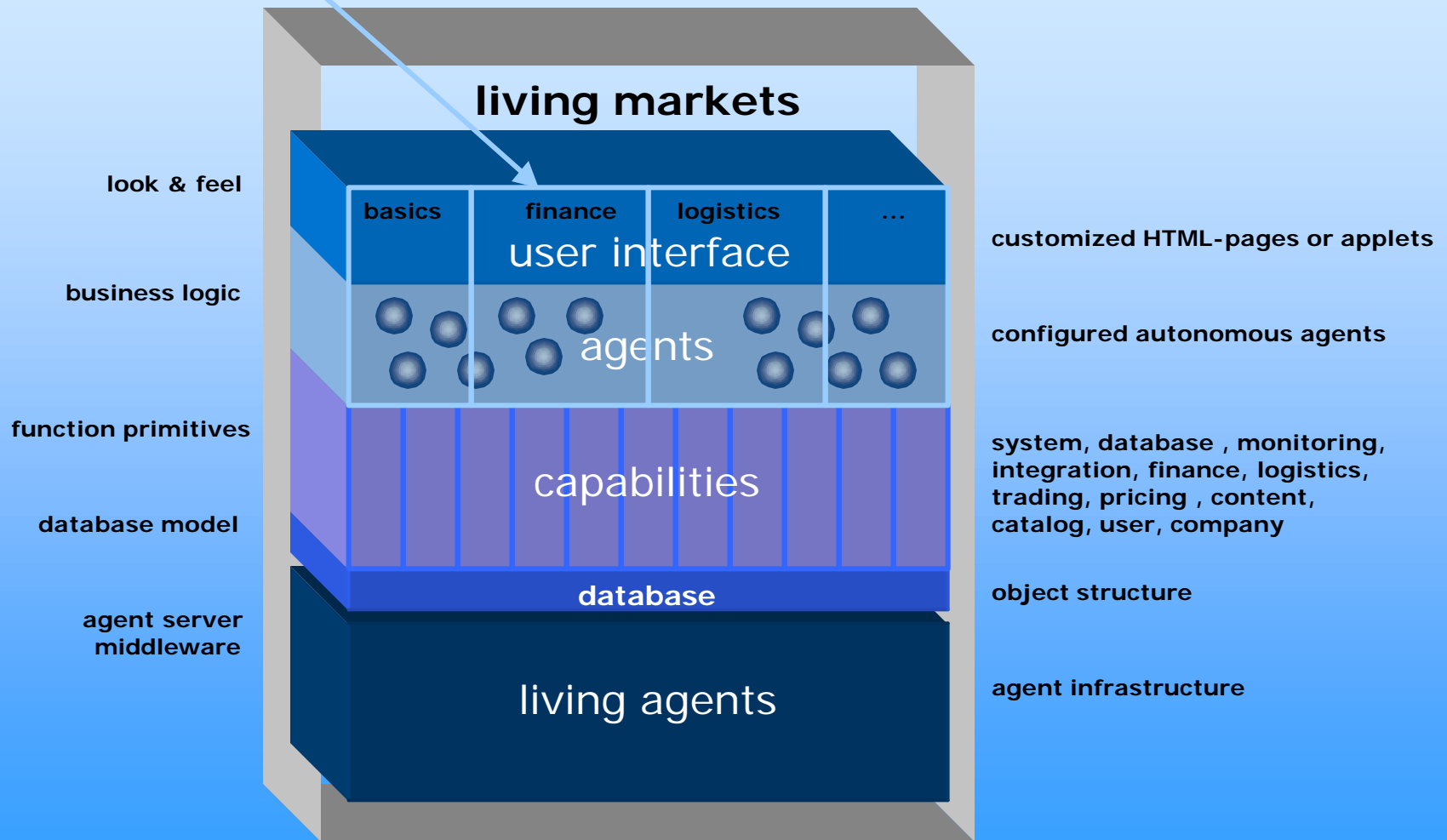
living markets ASN

living markets APN

finance
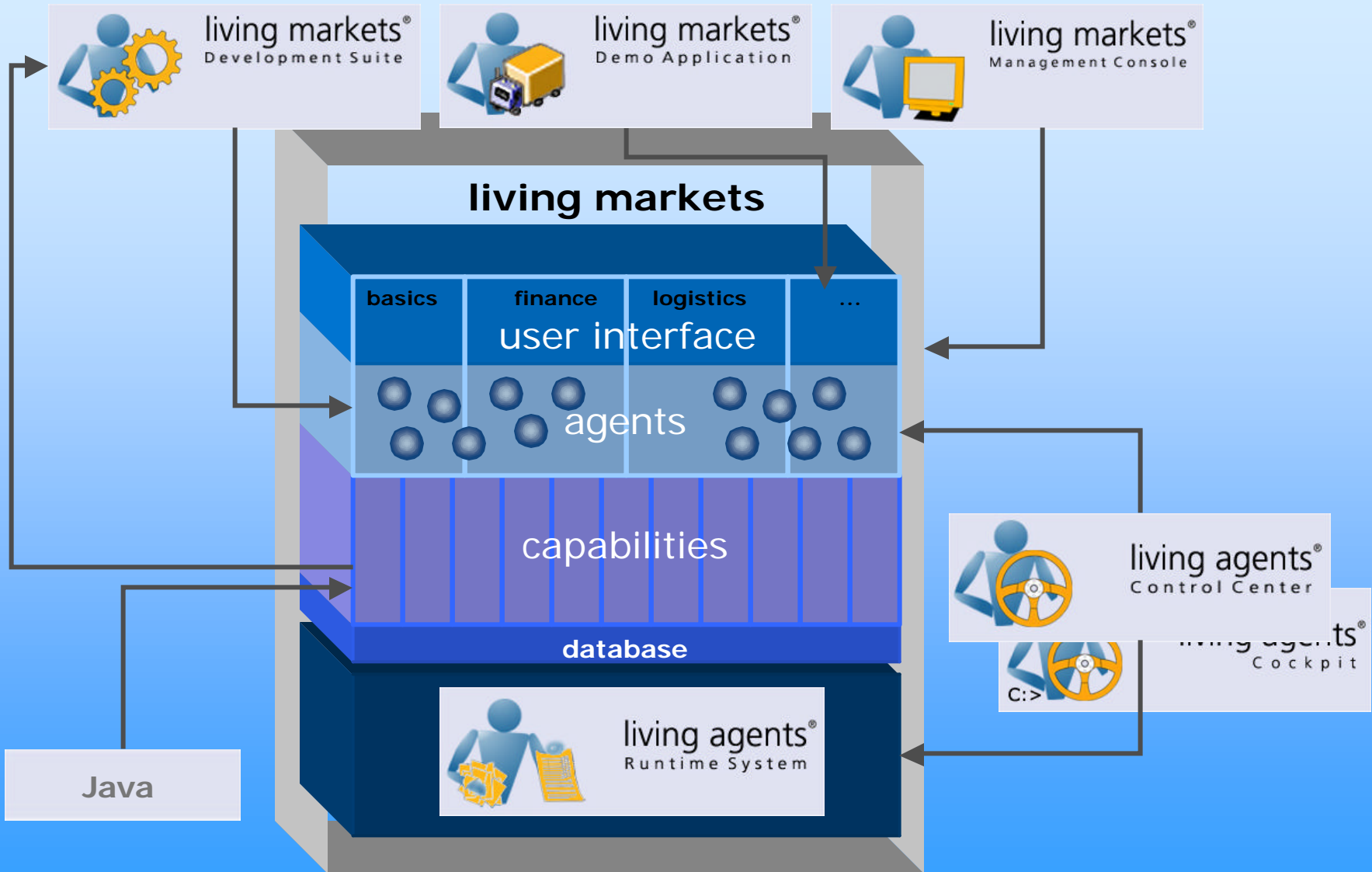
living markets AEN

living markets OTC

other solution

living agents
agent server

living markets Structure

vertical solutions

living markets

	basics	finance	logistics	...	

look & feel — customized HTML-pages or applets

user interface

business logic — configured autonomous agents

agents

function primitives — system, database , monitoring, integration, finance, logistics, trading, pricing , content, catalog, user, company

capabilities

database model

database — object structure

agent server middleware — agent infrastructure

living agents

living markets Toolset

Adaptive Execution in Business Networks

Thank you very much !

Agenda

living markets Position
living markets Products
living markets ATN
customers
agent paradigm
living agents Technology
living markets Solution Platform
Q & A

Adaptive Execution in Business Networks