- living systems
- living markets
- living agents
- live demo
- Founded in Germany in July 1996
- 120 employees worldwide
- Subsidiaries in France and Singapore
- €10m revenue in 2001
living systems AG provides Adaptive Execution solutions for Business Networks. Our software products close the gap between planning and daily operations through real-time information gathering, automation and instant optimization based on agent technology. We specialize in supply network execution and adaptive trading solutions.
History & Milestones

1996: Foundation in July
1997: Agent Mediated OTC TRAding System (AMTRAS) with partner „Deutsche Börse“
1998: agent based online auction
1999: Launch of eBay.de based on living markets
2000: Launch of 20 B2B Portals worldwide based on agent technology
2001: Launch of Transportation Portal of Deutsche Post World Net „Portivas“
2002: Presentation of the living markets product set for Transportation, Supply Net Management, Production Execution and Adaptive Deal Flow
       Presentation of the living markets visual agent development toolset
Adaptive Execution in Business Networks
### Awards

<table>
<thead>
<tr>
<th>Event</th>
<th>Location</th>
<th>Date</th>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trading Agent Competition</td>
<td>ACM Conference on Electronic Commerce</td>
<td>October 2001</td>
<td>Winner in Trading Agent Competition</td>
</tr>
<tr>
<td>World Economic Forum</td>
<td>Annual Meeting 2001 in Davos, Switzerland</td>
<td>January 2001</td>
<td>Leading Technology Pioneer</td>
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<tr>
<td>Preis der Baden-Württembergischen Elektrizitätswirtschaft</td>
<td>Verband der Elektrizitätswerke Baden-Württemberg e.V.</td>
<td>February 2000</td>
<td>Energy Trading System (ENTRAS) with software agents</td>
</tr>
</tbody>
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- living systems
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Company
Product
Technology
We face a network-driven economy:
- Supply Networks
- Demand Networks
- Production Networks
- Trading Networks
- Transportation Networks

Value creation evolves from in-house to network-driven
- Successful companies master their business networks
Adaptive Execution – “ready for the unexpected”

- Real life always deviates from plan:
  - in the negative sense: breakdowns, delays, bottlenecks
  - in the positive sense: ad hoc optimization opportunities

- Overall value creation depends on the capabilities of the network and its members to rapidly adapt in order to both avoid negative effects and exploit opportunities
  - “things simply happen”
Main characteristics of agents which enable adaptive execution in business networks:

- **Proactive**
  - Real-time visibility of actual events (operations issues, sales opportunities) as needed

- **Continuous**
  - Monitoring of business network to identify realistic solution space
  - Continually modeling solution strategy to evaluate alternate ways of achieving goals

- **Distributed control**
  - Local decision-making identifies win-win-solutions with peers
  - Mix of bottom-up/top-down optimization principles align local goals with overall goals of business network
Adaptive Execution Supplements Established Planning Levels

<table>
<thead>
<tr>
<th>Levels</th>
<th>Processes</th>
<th>Vendors</th>
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</thead>
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<tr>
<td>Automation &amp; Optimization</td>
<td>- Inventory Mgmt. &amp; Replenishment</td>
<td>Examples for Adaptive Supply Networks: living systems</td>
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<tr>
<td>Real-Time</td>
<td>- Customer Service/Inquiry Resolution</td>
<td></td>
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<td></td>
<td>- Order Mgmt</td>
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<td></td>
<td>- WMS Operations</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Transportation Planning &amp; Execution</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Invoicing &amp; Settlement</td>
<td></td>
</tr>
</tbody>
</table>
| Supply Network Management   | - Support Processes, e.g. Accounting, HR, Marketing | Examples for Order Fulfillment:  
- Viewlocity, Descartes
- ClickCommerce, NetVendor
- Xelus, SAP
- Yantra, EXE, Optum
- G-Log, Celarix
- Vastera, Nextlinx          |
| Tactical 1-18 months        | Order Fulfillment/Service Delivery            | Examples for DSP and Matching:  
- Xelus, i2, Manugistics, SAP/APO                                       |
|                             | - Collaborative DSP and Matching             |                                                                         |
|                             | - Service & Parts Strategic Sourcing         |                                                                         |
|                             | - Service & Parts Procurement                |                                                                         |
|                             | - Inventory management                       |                                                                         |
|                             | - Capacity & workforce planning              |                                                                         |
|                             | - Transportation Planning                    |                                                                         |
| Strategic > 18 months       | Supply Chain Strategy                        | Examples for SC Strategy:  
- Xelus, Manugistics, i2, SAP/APO                                       |
|                             | Service Parts Strategy                       |                                                                         |
|                             | Business Strategy                            |                                                                         |

Adaptive Execution in Business Networks
Traditional vs. Adaptive Execution Optimization

**Traditional Optimization (top down)**

- **Dependent nodes**
  - **Control Hub**

**Characteristics:**
- Reactive analysis of historical data
- Planning cycles, optimization of periods (not real-time)
- High level assumption driven aggregation
- ‘No transparency of details’
- Central system needs all relevant information
- Homogeneous system required
- Top-down linear optimization can not drill down to a list of execution level actions

**Adaptive Optimization (bottom up)**

- **Dependent nodes**

**Characteristics:**
- Permanent analysis of real-time data (exceptions/changes)
- Immediate optimization and reaction according to goals (real-time)
- Local optimization of real data (single events)
- Details are kept throughout the execution
- Identifies/coordinates options on a local base (collaboration) first
- De-central decision nodes only need local information and escalate if local optimum is not sufficient
- Robust across heterogeneous systems and beyond organizational boundaries
Adaptive Execution in Business Networks

living markets Products

- living markets ATN
- living markets ASN
- living markets APN
- living markets ADF
- Partner Solutions
- living markets Portal
- living markets Optional Modules
- living markets Base (agent server)
- living systems
- living markets
- living agents
- live demo
Paradigm Shifts

- Command oriented: 2GL, Assembler
- Function oriented: 3GL, C, Pascal, ...
- Object oriented: C++, Java
- Role / goal oriented: agents

Real world mapping (abstraction level)

Time
Agent Oriented Design

1. Agent/Role
2. Goal
3. Perception
4. Action
5. Domain Expertise
6. Capabilities
Living markets Structure

- vertical solutions

- look & feel
- business logic
- function primitives
- database model
- agent server middleware

- database

- living agents

- capabilities

- user interface
  - basics
  - finance
  - logistics
  - ...

- configured autonomous agents
- customized HTML-pages or applets
- system, database, monitoring, integration, finance, logistics, trading, pricing, content, catalog, user, company
- object structure
- agent infrastructure

Adaptive Execution in Business Networks
Adaptive Execution in Business Networks
Agent Communication Scenario

- Scenarios to keep the overview
- Highlights of each agent in one view
- Goals
- (web) services
- Free text description
- Agent communication
Agent Capabilities Configuration

Adaptive Execution in Business Networks
Business Logic Configuration (reactive)

- Available function primitives (capabilities)
- Clear structure of agent configuration
- Agent services are web services
- Drag&drop setup/change of business logic
- Online documentation of function primitives

Adaptive Execution in Business Networks
Business Logic Configuration (proactive)

- list of goals of the agent
- domain expertise to achieve the goal(s)
- living systems
- living markets
- living agents
- live demo
Applications

- Consumption units (store)
- Connections with varying speed (road)
- Transportation units (truck)
- Production units (factory)
Adaptive Execution in Business Networks

trucks inform each other about slow traffic
Dynamic Environment Example

- 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