

WHITESTEIN  
Technologies

Adaptive Solutions for Dynamic Markets

AgentLink III – Agent Technology Conference

Zürich, 1 October 2004

# Objectives & Agenda

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- ❑ Introducing Whitestein Technologies
- ❑ Dynamic Markets' Challenges
- ❑ Building Effective Solutions
  - Living Systems® Adaptive Transportation Networks (LS/ATN)
  - Living Systems® Connection Agent (LS/CA)
  - Adaptive Service Access Manager (ASAM)
- ❑ Conclusions & Questions



# Introducing Whitestein Technologies

# Introducing Whitestein Technologies



## An overview

- ❑ Whitestein Technologies was founded in 1999 with the *mission to be a leading provider of advanced software agent technologies, products, solutions, and services* for selected application domains and industries
  - ❑ Today a highly qualified, motivated and international staff of 70+ people distributed over four locations (Zurich - CH, Bratislava - SK, Donaueschingen - D, Sophia Antipolis - F)
  - ❑ A comprehensive approach for an ambitious goal:
    - A well-focused and balanced combination of *technology application, development, consulting* and *research*
    - *Strategic partnerships* with *industrial partners* in targeted market segments and cooperation with *academic institutions* in international research projects
  - ❑ Whitestein's view: the software agent paradigm as the *software engineering answer* to the increasing *complexity, dynamics and distribution* of the real world and markets
- For more information about Whitestein Technologies, you are kindly invited to our Press Event at 13:30h in the "Decision" room (ground floor)



# Dynamic Markets' Challenges

# Dynamic Markets



## Which markets?

- ❑ Telecom, Logistics, Financial Services...



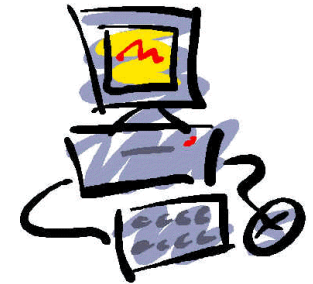
## From business challenges...

- ❑ Working under increasingly dynamic conditions and distributed constraints: high exposure to variability
  - ❑ Differentiation of offered products/services determines higher complexity in terms of business process management
  - ❑ Globalization/liberalization increases competition and thereby the need for quick and flexible reaction to customers' expectations and requirements
  - ❑ Extension of business horizons determines an exponential growth of information to be processed and analyzed
- This translates into a set of stringent business needs and technological requirements



### ...to technological requirements

- ❑ More frequent adaptation of software systems and hardware infrastructure
- ❑ Higher amount of data to gather, analyze and visualize
- ❑ Higher distribution of systems
- ❑ Interoperability with a higher number of diverse technologies and tools
- ❑ Integration of different business processes at both intra- and inter-enterprise levels
- ❑ Adaptation of applications and content to accommodate to heterogeneous users' expectations / backgrounds / roles



### The problem

→ Today's IT systems are usually based on technologies unable to provide the required flexibility to meet new business needs and IT requirements

...without forgetting that in the last three to four years many businesses significantly reduced their IT budgets



### How can agent technology help?

- ❑ To cope with business requirements of dynamic markets by making it possible to
  - Flexibly extend functionality of existing systems (including solutions' customization)
  - Support an effective integration of networked businesses
  - Provide advanced and innovative solutions for upcoming business & market models

### Agent technology is understood as:

- ❑ A comprehensive approach to model and build software... not just a “technology”
- ❑ *Software agents* conceived as *configurable, distributed software components* that:
  - Assume *role-based* business responsibilities
  - Aim to achieve *given business goals*, following *given business policies*
  - *Autonomously* work (own thread of control) *on behalf* of and/or *represent* their owners
  - Can *communicate* in order to coordinate and cooperate (asynchronous messages)



# Building Effective Solutions



## LS/ATN - Living Systems® Adaptive Transportation Networks

- ❑ The *optimization solution for comprehensive planning and monitoring of logistics processes*
  - Immediately reacts on changes/events and proposes new solutions
  - Presents the results graphically and focused on the dispatchers workflow
  - Integrates with existing transportation management systems and telematics solutions
- ❑ *Challenges* arise from the *very dynamic and heterogeneous nature of this market*
  - Many different customers, trucks and kinds of transportation
  - Many different business structures (processes, culture, IT)
  - Many unexpected events (new/changed orders, delays etc.)
  - High complexity due to the interaction of different regional/organizational units, which often have different strategies and approaches to dispatching
  - Decentralized responsibilities



# Adaptive Transportation Networks (cont.)



## Traditional approaches

❑ Planning, coordination, and optimization take a *top down approach*

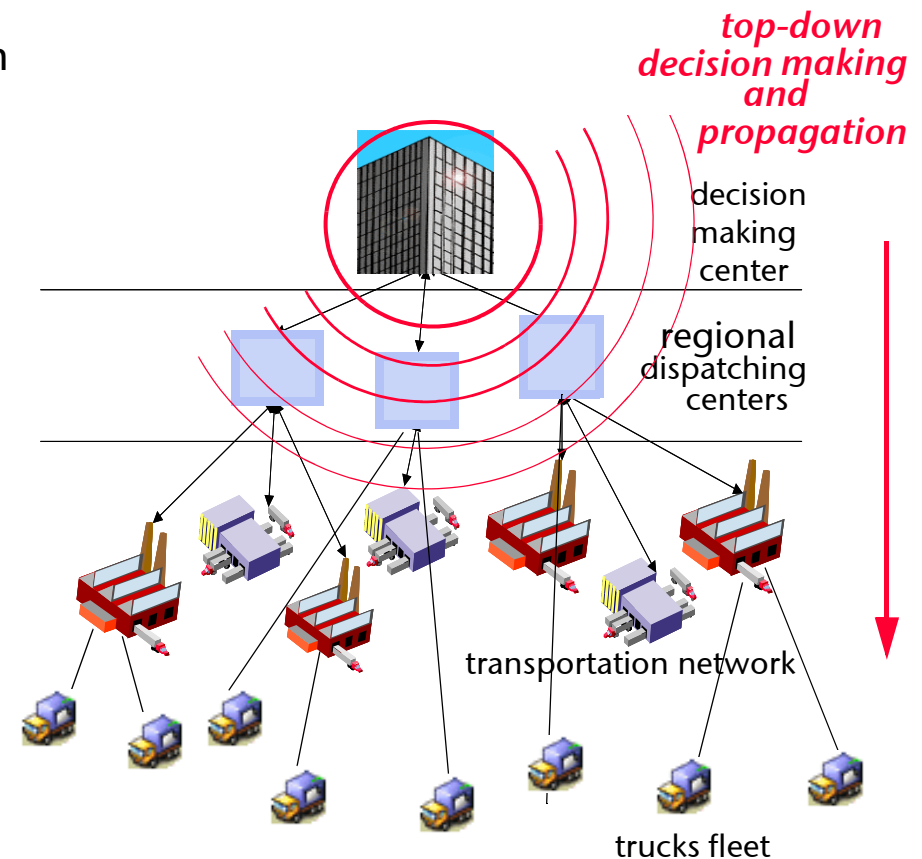
❑ *Centralized* model, algorithms, computation

- Information and events collected & processed centrally
- Decisions/plans are then propagated

❑ Traditional planning or optimization solutions:

- Batch-planning
- Historical statistical data
- No event-monitoring / looking-ahead

... *optimized handling of plan deviations*  
in real time *is not feasible*

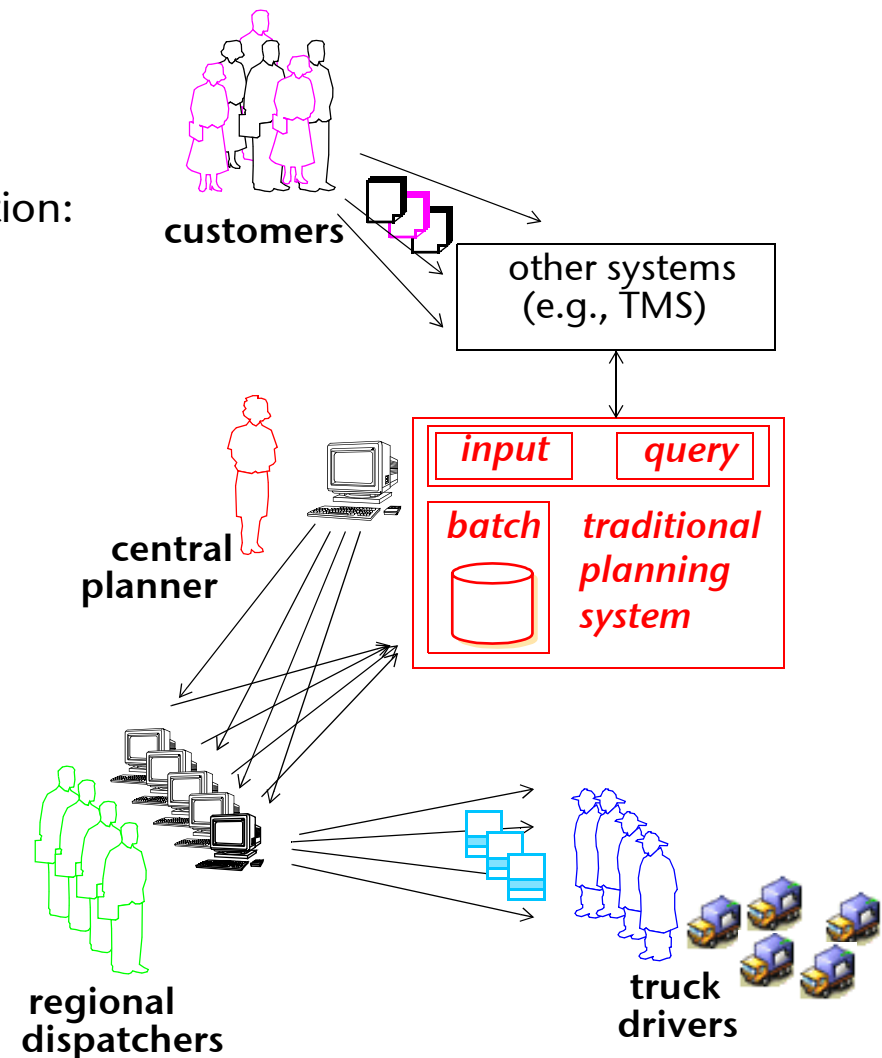


# Adaptive Transportation Networks (cont.)



## Main limitations

- ❑ Highly un-automated
- ❑ The central planner needs complete information:
  - Orders, trucks availability / characteristics
  - Transportation networks (hubs, etc)
  - Geographical / routing data
- ❑ Drawbacks:
  - All information needs to be rendered homogeneous for central processing
  - For local changes to be properly propagated several communication flows introduce additional overhead
  - Single point of failure

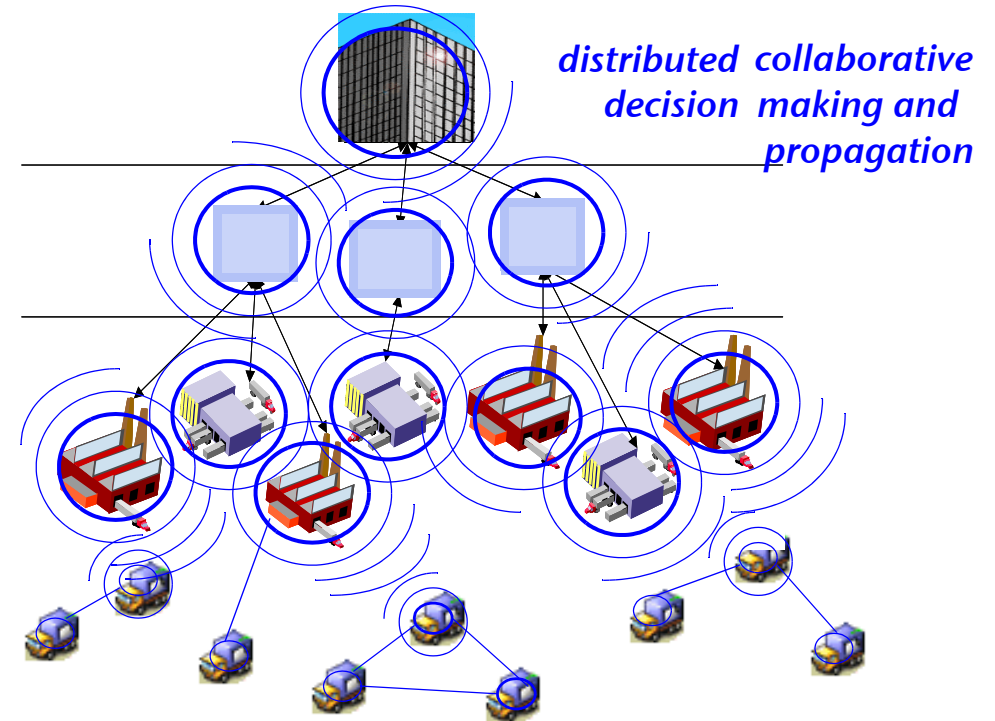


# Adaptive Transportation Networks (cont.)



## LS/ATN approach

- ❑ *Distributed and decentralized agent-based* planning, coordination, and optimization takes a *bottom-up* approach
- ❑ A role-based model: delegated responsibility to master business and systems complexity
- ❑ Mapping a business model 1:1
- ❑ Communication between nodes as needed (determined at run-time)
- ❑ Detect & react to changes in real-time: best local answer to plan's deviations
- ❑ Proactive monitoring of business network to adapt solutions' space
- ❑ Optimization based on a permanent cost calculation (economic model)

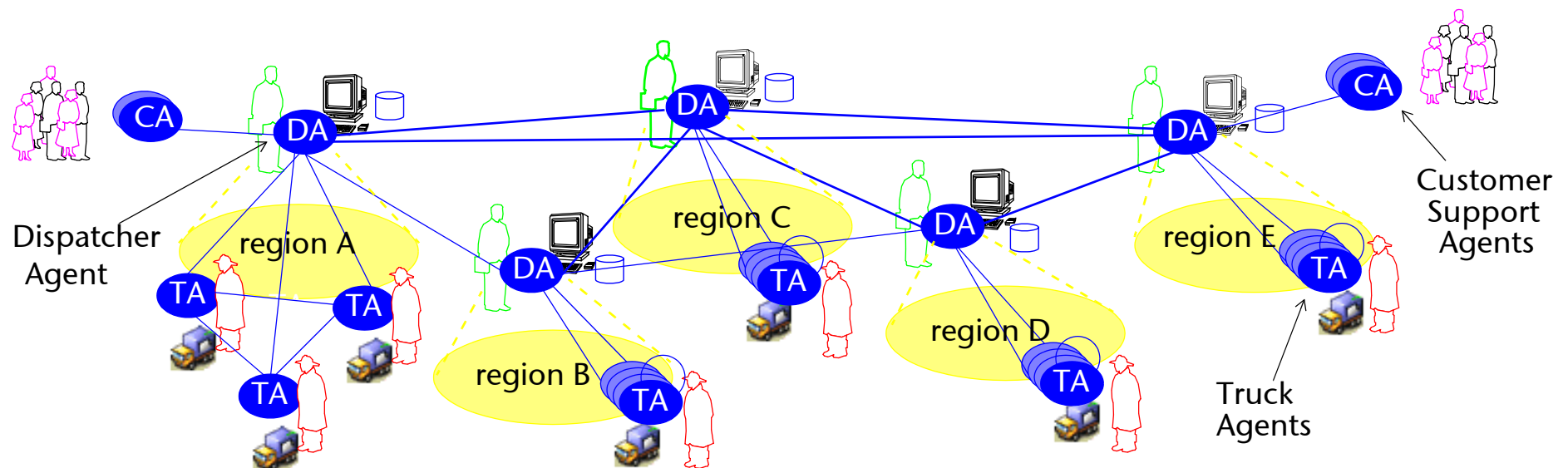


# Adaptive Transportation Networks (cont.)



## Overcoming traditional IT systems' limitations

- ❑ By means of electronic assistants (agents), many tasks can be automated:
  - Complex computations (e.g., provide the *best out of thousands of combinations*)
  - Routine jobs executed at high speed
- ❑ No need to centralize information
- ❑ Timely behavior: decision entities “closer” to the resource they directly control

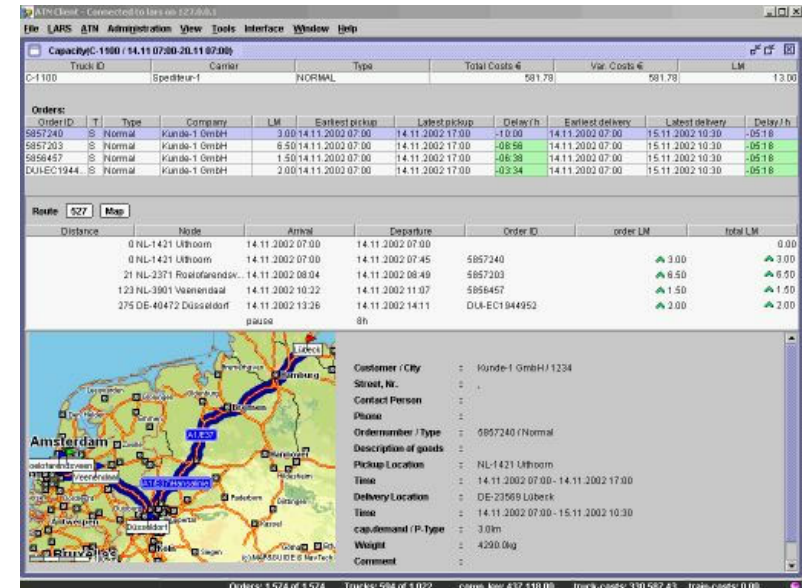


# Adaptive Transportation Networks (cont.)



## LS/ATN benefits

- ❑ Higher utilization of transport capacity (i.e., reduction of transportation costs)
- ❑ Lower process cost and better visibility
- ❑ Automated dispatching and plan deviations handling (dynamic route optimization)
- ❑ Increased service level (on-time delivery improved)
- ❑ **Results obtained by running ATN on real data**
  - Reduction of *transportation costs of about 3-6%*
  - Significant reduction of driven kilometers at same service level
  - Through higher capacity utilization the driven kilometers can be reduced by up to 4%
  - Order constraints' violations can be eliminated by slight increase of driven kilometers



# Toward Ubiquitous Computing



## Swisscom Mobile launches a world premiere in Mobile Unlimited

“...Mobile Unlimited guarantees uniform access to and automatic switching between UMTS, GPRS and WLAN...The core components of the product are the Unlimited PC Card together with the *Software Unlimited Data Manager*.” [Swisscom Mobile news, 09.09.2004]

- ❑ The *Unlimited Data Manager (UDM)* is a software solution built by Whitestein Technologies for:
  - Facilitating *usage of 2G, 3G and WLAN services* – “one click access”
  - Providing *seamless handover* for ubiquitous wireless broadband data and multimedia services
- ❑ UDM makes use of the *Living Systems® Connection Agent (LS/CA)*
- ❑ Driving design and implementation principles / objectives
  - Automatic policy-based selection of the best available access network
  - Establishment and management of network connections’ functionality available at finger tips for increased user convenience



# Toward Ubiquitous Computing (cont.)



## LS/CA - Living Systems® Connection Agent

- ❑ An agent-based solution providing:
  - Sophisticated management of access networks (2G, 3G, WLAN, Ethernet, POTS, etc.)
  - Management of network connections based on user policies and preferences
  - Extensible Authentication Protocol (EAP) support, security features (IEEE 802.1x)
- ... and a modular architecture that integrates with seamless handover networking components and enables authentication in operators' public WLAN
- ❑ Software entities (agents) running on a variety of 2G, 3G and WLAN users' devices to:
  - Hide low level networking complexity
  - Personalize network connections management
  - Automate choices based upon pre-defined user preferences



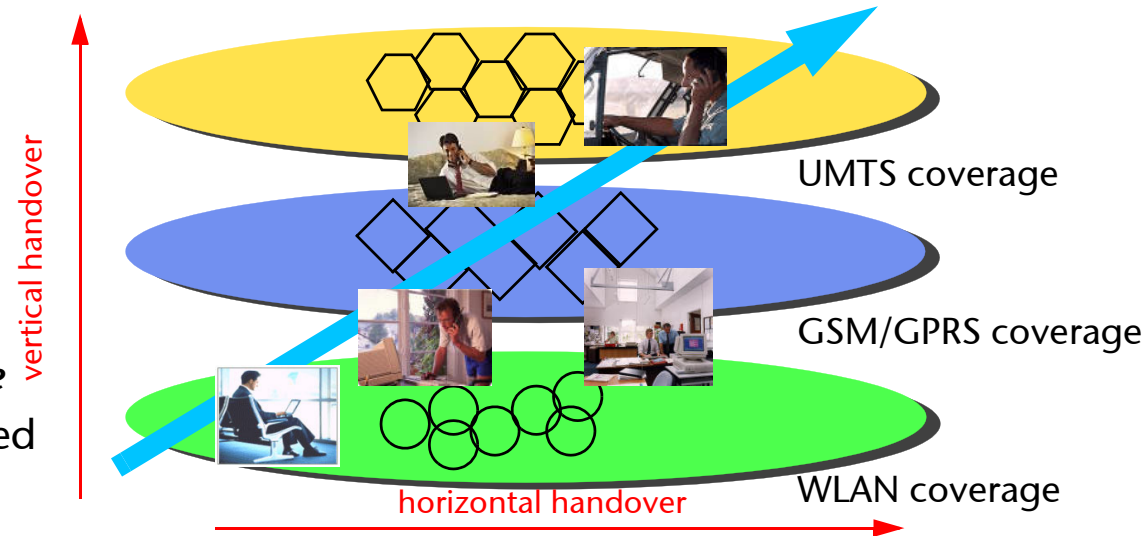
# Adaptive Service Access Manager



## Dynamic and adaptive access to communication infrastructure for mobile users

□ A *distributed software architecture* for intelligent management of service access:

- Light-weight agents populating end users' devices for enabling *dynamic control of network connectivity*, resources, services and offered quality
- *Optimization of network resource allocation* (by means of distributed agents) and thereby providers' profit



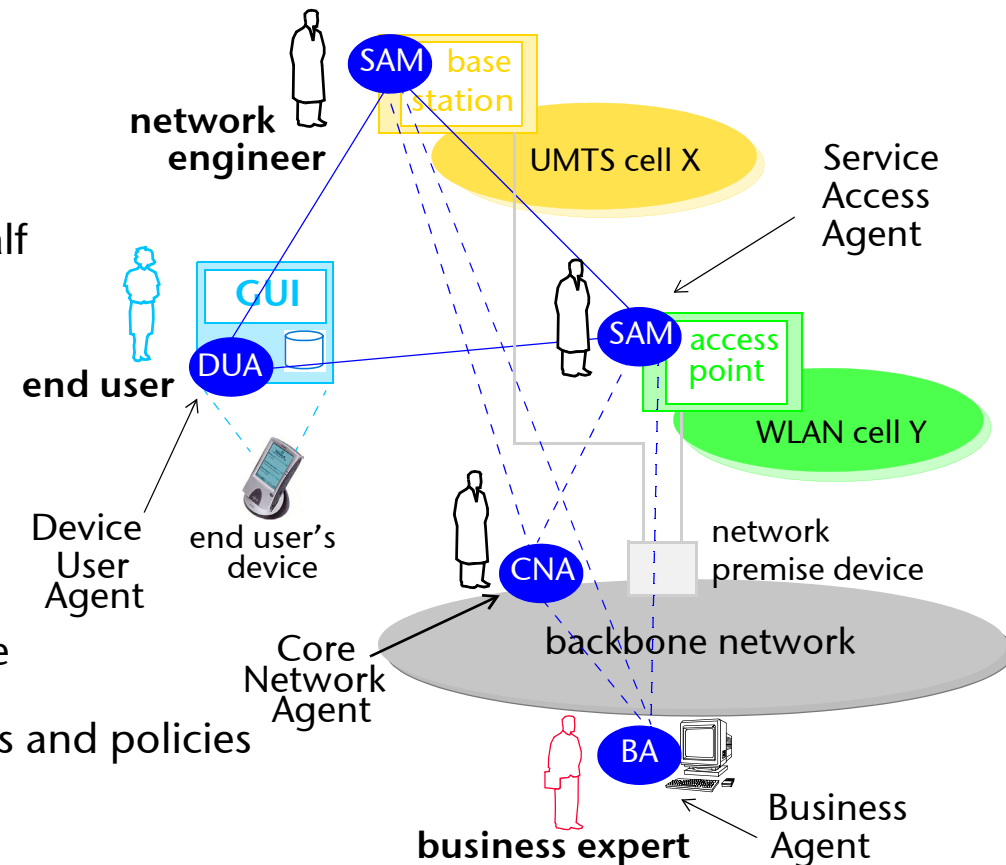
→ Extending the LS/CA to provide seamless network connectivity *with appropriate QoS guarantees*, by means of *adaptive handover mechanisms* that *dynamically* take into account existing network constraints/availability, device properties and user preferences

# Adaptive Service Access Manager (cont.)



## An architectural overview

- ❑ *Device User Agents* for managing network connectivity and access to a variety of communication services on the users' behalf
- ❑ *Service Access Agents* for connections' management (set up, tear down and handover) within a given access domain
- ❑ *Core Network Agents* for enforcing network and service management policies from a backbone-wide network perspective
- ❑ *Business Agents* for enforcing business rules and policies



## Main principle

- *Dynamic mediation* between user preferences and provider options enables customer satisfaction to be increased and network resources utilization to be optimized

# Adaptive Service Access Manager (cont.)



## Major benefits

- ❑ Load balancing across various network access domains
  - ❑ Optimization of network resource allocation
  - ❑ Increased customers' benefit and satisfaction
  - ❑ Possible QoS adaptation
  - ❑ The integration of ASAM with the LS/CA further allows:
    - Support for more elaborate policies taking QoS and/or special network services into account to offer advanced telecom services (e.g. VoIP)
    - Change or influence network selection in a multi-technology environment (e.g. UMTS, EDGE, PWLAN) while taking user policies and context into account
    - Reduce cost of network service provisioning by shifting users to cheaper networks
- Ongoing experimental work to quantify the benefits based on concrete use case scenarios





## Conclusions and Questions

# Conclusions

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## Summary

- ❑ Dynamic markets are pressing for more dynamic and flexible IT solutions able to:
  - **Adapt**, when circumstances change, their behavior by means of learning capabilities, continuous monitoring of the environment, reactive and proactive actions
  - **Personalize** offered products/services so that they better fit to particular people, place, times and events by acquiring and making use of context-relevant information
- ❑ Agent technology provides powerful metaphors, concepts and techniques for conceptualizing, designing and implementing effective solutions
  - Agents facilitate one-to-one mapping of **real world business models**
  - Agents as **smart decision making** support components in complex, dynamic, and networked markets
  - Agents for **delegation of work load** by performing tasks that would be otherwise very difficult, time consuming, costly or just infeasible for humans

# Conclusions (cont.)



## Summary

- ❑ Whitestein Technologies *real-world experience* confirms that software agents can:
  - Flexibly extend functionality of existing systems (including solutions' customization)
  - Support an effective integration of networked businesses
  - Provide advanced and innovative solutions for upcoming business & markets models

... but only when:

- Providing solid agent methodologies, platforms, tools and products for industrial-grade development and deployment of agent technology
- Facilitating the understanding of agent technology in close combination with specific application-driven business requirements
- Taking into account dynamics of markets and technologies

- ❑ Questions...?

