Amit - Active Middleware Technology

Active Services in Wireless Environment

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OUTLINE:

- A mit
- The situation concept
- Active Services in Wireless Environment
- Current and future work

what is this talk about?
Active Middleware Technology
Active Management in a Nutshell

1st sting is harmless, if you are not allergic.

2nd sting is most probably harmless, but beware of the 3rd one - use protection remedy!

3rd sting will most probably harm!

- Single event ("a sting") is often meaningless, but **Events composition** ("3 sequential stings") - is meaningful !!!
- **Events correlation** is important ("consider stings related to the same person").
- **Timing** is important ("3 stings which happened within at most 3 weeks").
- **Conditions** are important ("if you are not allergic").
- Events may have **Uncertainty** degree ("most probably harmless").
- **Context** is important ("in Africa probability is lower than in Europe").
- Reactive behavior ("after the 3rd sting") may be too late, but **Proactive** ("beware of the 3rd sting after the 2nd one") - desirable !
- Different **Strategies** may be suggested ("use ointment or spray").
- **Predictions** may be done ("if more than X persons suffered in the same area, the area is dangerous!").
Active Applications

- **Reactive**: React to something that happens in the system
- **Proactive**: Use predictive methods to redirect the system towards better results and/or eliminate problems (or warn in advance)
What is the main idea of Amit?

- In many cases, a single event is meaningless to an application, however a (possibly complex) combination of events is required.
- Example: Alert me if the IBM stock has gone up in 3 percent within two hours, and the Dow Jones did not go up in more than 1 percent at the same period.
A situation example

- Basic event: stock-report: IBM-quote, Dow-Jones
- defined Situation:
  - situation IBM-quote-alert
  - sequence
  - from stock-report as s1 retain, stock-report as s2
  - where ( s2.IBM-quote > s1.IBM-quote * 1.03 and s2.Dow-Jones < s1.Dow-Jones * 1.01)
  - initiator s1
  - expiration 2 hours
The language issue:

- Styles of languages:
  - An SQL like language (superset)
  - XML for data exchange
  - A Wizard
Amit Architecture

event sources

event adapter

definitions

events

AMIT

system designers

authoring tool (Amit GUI)

subscription and action manager

situation alerts

users
<table>
<thead>
<tr>
<th>Application Types</th>
<th></th>
<th></th>
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</thead>
<tbody>
<tr>
<td>Customer Relationship Management</td>
<td></td>
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<tr>
<td>System Management</td>
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<td>Maintenance Management</td>
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<td>Service Management</td>
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<td>Policy Management</td>
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<td>Network Management</td>
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<td>Business Processes Management</td>
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<tr>
<td>Personalized publish/subscribe</td>
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<td>Monitoring Systems</td>
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<td>Active Services in Wireless Environment</td>
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<td>Multi-sensor diagnostic system</td>
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<td>Command and Control systems</td>
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**Active Management Technologies**
The concept of Situation
Monitoring Situations:

1: An open request with priority > 3 did not receive any reply for 2 hours

2: A preferred customer sent request with higher priority for the same contact

3: A request was reassigned at least 3 times

Report: request, last assignment time
The Situation Primitive

- General Information
- Participating events (or database records)
- Matching keys
- Attributes (can be derived)
- Lifespan boundaries
The Building Blocks

Joining Operators:

all, sequence

Counting Operators:

atleast
atmost
nth
operator types:

temporal operators: every, after

absence operators: not, unless
Situation example:

The customer sent request with higher priority for the same contact

situations {preferred-customer-is-mistreated}
sequence from open-request as first-request
  open-request as second-request
where

customer.customer-status = "preferred" and
second-request.priority > first-request.priority
key-by key-contact
Lifespan

- A time interval in which a situation is meaningful.
- Bounded by two events: initiator and terminator.
## Performance - Benchmark Results

<table>
<thead>
<tr>
<th>World</th>
<th>detected situations / incoming events</th>
<th>% of events participate in situation definition</th>
<th>events per second</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standby World</td>
<td>0%</td>
<td>no situations definition</td>
<td>120,000</td>
</tr>
<tr>
<td>Noisy World</td>
<td>0.3%</td>
<td>1% of events participate in situation definition. No reference events</td>
<td>47,000</td>
</tr>
<tr>
<td>Middle World</td>
<td>4.5%</td>
<td>25% of events participates in situation definition average of 0.3 reference events per incoming instance</td>
<td>22,000</td>
</tr>
<tr>
<td>Complex World</td>
<td>24%</td>
<td>75% of events participates in situation definition lots of reference events complicated situations</td>
<td>2,200</td>
</tr>
</tbody>
</table>
What we are doing now?
Deep Temporal Issues

■ Problems:
  ➔ The detection time may not be the actual event occurrence time.
  ➔ Different sources may not have synchronized clocks.
  ➔ The order of events detection may not reflect the real order of event occurrence.

■ Solution Directions ???
  ➔ Using techniques from the temporal database area.
  ➔ Using techniques of uncertainty handling.
Uncertainty issues

- Events with certainty value.
- Situation detection with certainty values.
- Flexible meaning and propagation (including causal relationships among events).
Recovery and fault tolerance issues

- Problems:
  - Recovery of the situation manager
  - Recovery of a source
  - Recovery of a destination
  - Communication time-out
  - Transaction management issues (a macro level issue).
More active technologies:

- run-time monitoring
- automatic action creation
- dependency and inference
Inferred situations

- Situations are inferred from constraints and dependencies.
- A simple example:
  - We define a constraint
    \[ \text{department.budget} > \text{sum} \left( \text{employee.salary} \right) \]
    such that employee belongs to the department
  - A situation that entails a constraint evaluation is:
    any (new employee hiring, reassignment of employee, salary raise, budget reduction).
  - This can be inferred
Automated Decision Making

- A complimentary technology to active detection.
- The goal: selecting appropriate action when any decision may effect the entire system, using the fact that we maintain current view of the system for monitoring purposes.
- Current status: work on SLA issues in various areas.
Spatio-temporal support

- Events that relate to combination of time and space.
- Applications: location related.
Extreme Blue –
Active Services in Wireless Environment
Mobile Service Example

Service site
Mobile Service Example – e-Health

Service site
Mobile Service Example

middleware
Project Goals

The main goal: Develop a proof of concept application in the area of active services in wireless environment. This proof of concept will demonstrate utilization of Amit (Active Middleware Technology) extended with location-based context.

- Support wireless sources of events and knowledge to the system.
- Support wireless destinations of broadcasting situation as: conclusions, alerts, required actions.
- Support real-time decisions based on tracing and correlating multi events from various sources.
- Support real-time spatio-temporal situations / conclusions / alerts.
The Combined Architecture

The server

- Other Sources/subscribers
- Rule engine wrapper
- PIKS server
- Knowledge-Base
- Location base
- Location simulator

The client

- Cellular modem
- Pervasive device

Amit GUI
The projects’ perspective
Pervasive Devices

- Palm Pilot
- Cellular Phone
- Visor
- Think Pad
Thank You!
Situations in a Wireless Environment

- Alert when pulse measurement received from a customer is greater than 120 pulses/sec
- Take several various measurements from a person. Report a “possible problem” when a specific combination of measurements values, is received concurrently.
- Report on the nearest available doctors to the customer (in trouble…) that have the skills to handle the specific sick person. Call the appropriate doctor.
- Report on any nearest (available or not) doctors to the customer (in trouble…) Call the appropriate doctor
Situations in a Wireless Environment

- Notify the customer where is the nearest Hospital / clinic handling his problem
- Conclusions: The alerts / situations / reports are produced (to the customer, doctor, clinic, hospital) according to:
  - The events / measurements (and their attributes values) arriving from the customer and form the other actors (other customers. Doctors, hospitals…)
  - The locations of each of the events-producers and the Situations subscribers.
Benefits:

- **Personalized concept of events**: the client receives its mental concept of event, and not intermediate events.
- **Reduced amount of programming**: reduced time and cost, and increased reliability.
- **Reduced amount of messages traffic**: only situations are reported to the users, not raw events.
Amit - Current status

- Amit is a mature technology, getting into one IGS offering (eBM) and one SWG product (WCCD), both GA in 2001.
- Currently it works with various types of events using standard interfaces.
- Amit is written in Java, and can run in any environment.
- Under development there are additional tools to infer rules from higher-level abstractions and to create automatic actions (to create a family of products).