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## D7.1: Scenario Description

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### i2home

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# 1. Introduction

The purpose of this document is to outline possible scenarios especially with respect to work package “WP7 – Activity Management”. Within i2home the *Activity Management* (AM) is understood as a high level context management system. In this context high level management means that a set or chain of independent or dependent tasks with respect to all input and output devices connected to the i2home system has to be defined and processed. While context management on an atomic level is understood as taking decisions on the level of a single input or output device (e.g. how to display a notification event on a PDA) the Activity Management is responsible for:

- Taking decisions with respect to the user's context: The user's physical and mental disabilities are taken into account to ensure adequate system reactions.
- Taking decisions with respect to connected devices: All incoming and outgoing of both input and output devices are analyzed. Depending on the current situation of the environment, the user's context and stored context rules events are either directly let out to the device or if necessary events are rearranged or new events are generated and sent to the device.
- Taking decisions with respect to events: The i2home AM module is monitoring all connected devices. Considering the user's and environment's context notifications are produced to enforce user's intervention is necessary.
- Taking time driven decisions: Under certain circumstances sensor signals are not immediately processed to avoid keeping the user in leading-strings, but will be delivered in urgent cases only. Events are shifted with respect to their relevance and importance within the user's daily life (flexible reminder events).

In deliverable “D1.3 - Scenario Description Report” [20] seven different scenarios for the defined i2home personas are described in separated chapters. Each chapter contains a typical day (or major part of the day) of a respective persona. In contrast to this approach, the actual deliverable identifies short elements of the scenarios (scenario fragments) that should be handled by the Activity Management, associates them to according AM tasks and describes the problems and possible solutions to ensure a most natural system reaction. These scenario fragments are assigned to the following two logical chapters, that are describing the core concepts and the functionality of the Activity Management used in the i2home second phase demonstrators:

- Activity-Aware Reminders
- Event-relational Algebra with
  1. Time-based and Priority-based event relations
  2. Activity Sets, Chains and Trees

Depending on the outcomes of the evaluations and user tests of the first and second phase i2home demonstrators, fragments of scenarios may be later on modified or adapted or even new snippets will be added to the scenarios.

## 2. Flexible Reminders

Within the i2home project the concept of *Flexible Reminders* (FR) is introduced, which can be understood as a concept of context- and activity-aware notification and event handling. Traditional reminder applications such as calendar systems [4],[6],[7],[8],[9],[10] and scheduler systems [3],[5],[11] store time based events as one-time occurrences (single date-time-events like 'Meeting on Monday, 1<sup>st</sup> of September at 14:00 o'clock'), recurring events (like yearly recurring birthdays, daily meetings, meetings the user has every third Friday of every month) or time intervals with a starting and ending date-time events (see figure 1). Such systems are not able to handle overlapping events or multiple events that occur at the same time adequately. Either those events are rejected directly during keying in new events due to collisions or colliding events are accepted and will logically produce multiple notifications at the given event time. Those restrictions can be seen at all kinds of system whether they are commercial products or freeware applications.

30 min.	Mon 23	Tue 24	Wed 25	Thu 26	Fri
08:00 a.m.	(+)	(+)	(+)	(+)	(+)
09:00 a.m.	(+)	(+)	(+)	(+)	(+)
10:00 a.m.	(+)	(+)	LC Team 10:00 a.m.-11:30 a.m.	LAC 10:00 a.m.-12:00 p.m.	(+)
11:00 a.m.	(+)	(+)	(+)	(+)	(+)
12:00 p.m.	(+)	(+)	(+)	(+)	(+)
01:00 p.m.	11 w/MS & JW 01:00 p.m.	(+)	(+)	(+)	(+)
02:00 p.m.	(+)	(+)	Library Facilitato...	(+)	(+)
03:00 p.m.	All-Staff Meeting 02:30 p.m.-04:00 p.m.	LFA 03:00 p.m.-05:00 p.m.	02:00 p.m.-03:30 p.m.	(+)	(+)
04:00 p.m.	(+)	(+)	(+)	(+)	(+)
	No Entries	No Entries	No Entries	No Entries	No Entries

Figure 1: Typical application with one-time occurrences (courtesy of Oracle Corporation [9])

Basically, those applications lend themselves as electronic versions of the traditional paper-based calendar. Only a few extensions are given for the electronic versions by the obvious possibilities of using electronic calendar and reminder systems: Often, notifications are pro-active. If a new event occurs, either a visual or an audio notification is displayed. As an analogy to a common alarm-clock, there is often the possibility to enforce a confirmation by the user. Without this confirmation, the system provides additional reminders for example every five minutes until explicit confirmation. Nevertheless, if an event takes longer than expected, the following dates and appointments are not automatically shifted, deleted or rearranged.

Especially the calendar configuration (entering new events into the calendar or reminder system) is still technologically driven and not learnt by daily life (see figure 2). Typically, only exact dates, intervals or occurrences can be entered. This idea may be acceptable for managing work-related events like meeting dates or reoccurring intervals for telephone conferences, but for managing our daily life this concept is obviously too inflexible.

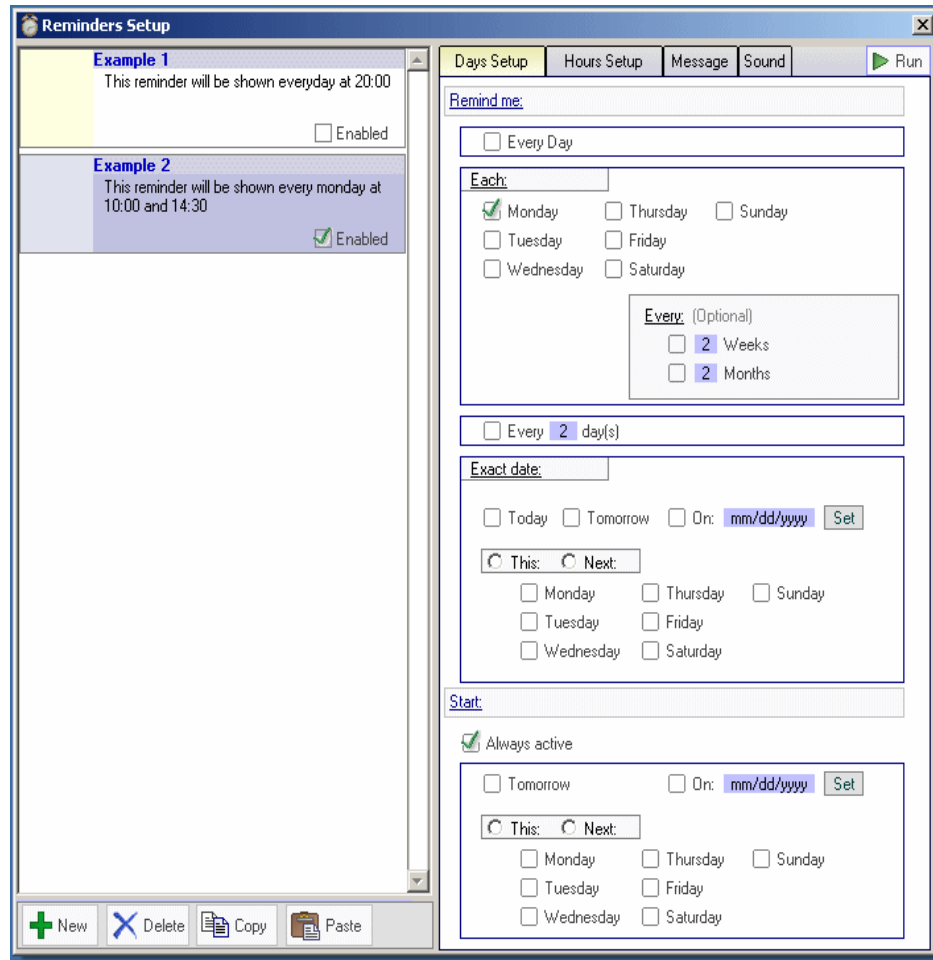


Figure 2: Example of a typical reminder configuration (courtesy of G.F. Software [8])

Day-to-day events are mostly flexible with respect to their occurrence and their need to be carried out. Here, just a few simple examples shall be mentioned:

- Going to bed at night may be daily scheduled to a fixed time. Assuredly no one understands this as an exact and definite occurrence that have to be done without any delay or even ahead of schedule. The actual time varies day by day depending on wide range of reasons and circumstances taking into account, that someone is currently watching television, has a visitor at home, has to wake up early next morning due to an important appointment or is doing overdue housework.
- Someone is awaiting a visitor at home and this visitor is expected to arrive for coffee or tea at 15 o'clock. Nobody would expect the door bell ringing at exact the appointed time. He/she would think about the visitor arriving if the door bell rings ten minutes early or only at a quarter past three.
- Usually the treatment plan for medication is described by medical doctors with very fuzzy phrases like "Take two pills in the morning!", which can be interpreted as "at some point between six and ten o'clock in the morning".

In particular the users of the i2home system with their cognitive and sensory impairments

should not be forced to use technology that is far away from intuitive handling and has to be learnt laboriously. Therefore, the necessity for using flexible reminders arises directly from first evaluations of the i2home phase one scenarios (described in deliverable D1.3 “Scenario Description Report”, [20]) and their implementation and demonstration after the first year of the i2home project. Remember for example scenario #5, “Manuela at home”, where for the reminder to take her medicine at ten o'clock an avatar is displayed on the television screen (while she is watching TV). Who would not become very angry at that reminding avatar (or at the system behind), if he/she would be watching an enthralling movie (which is ending at five minutes past ten) and would miss the most important sentence (like “...and the murderer is...”) just before the end of the movie, because “the avatar is not flexible enough to wait for just five or ten minutes” with this notification.

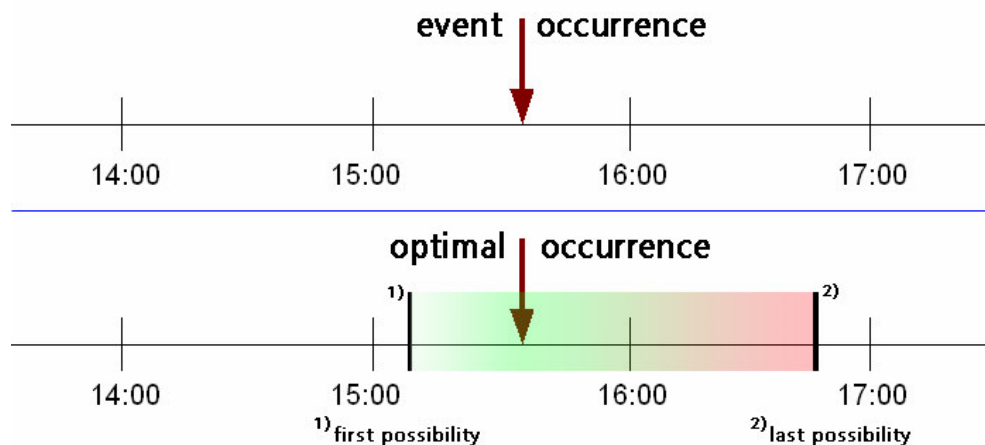


Figure 3: Rigid reminder (top) and flexible reminder (bottom) concept for one possible event

To avoid problems like those described above and therefore to increase the usability and acceptance of the system, the Activity Management module of i2home will make use of the Flexible Reminders concept. Flexible Reminders are understood as an extension of rigid event reminders, which traditionally contain a date and time specification for the event occurrence and an additional associated notification text or link to adequate multimedia content like audio or video files, which are displayed or played back at event occurrence. A Flexible Reminder extends this occurrence date and time by an asymmetrical interval placed around the optimal event occurrence (see figure 3). Provide different distances 'left' and 'right' to the optimal occurrence time is necessary due to the fact that often events are directly actuated by an event occurred directly prior to this new event and, therefore, only a delay for the newer event is possible and acceptable. The entire interval of the reminder event is weighted by a linear interpolated parameter, which indicates the importance of the notification within the occurrence interval. Without collision or overlapping with other reminder events the originally stored optimal occurrence time is used for the notification. If two or more Flexible Reminders partially share the same time span, the Activity Management will calculate for all affected reminders an event time as close to their optimal occurrence time as possible. Mathematically spoken: The sum of importance parameter values of all events in each moment is minimized. Practically, the specification of the interval limits is optional but not mandatory. If only a single date and time occurrence without broader interval limits is set the flexible interval length is automatically set to zero and the event occurs traditionally at the given time. Furthermore, it is possible to associate different notification

resources within the occurrence interval, which depend on the actual position of the current time within the reminder interval.

### Example:

The following example of a Flexible Reminder will be similarly used in the scenario 'Manuela at home', which will be described in the next section of this chapter.

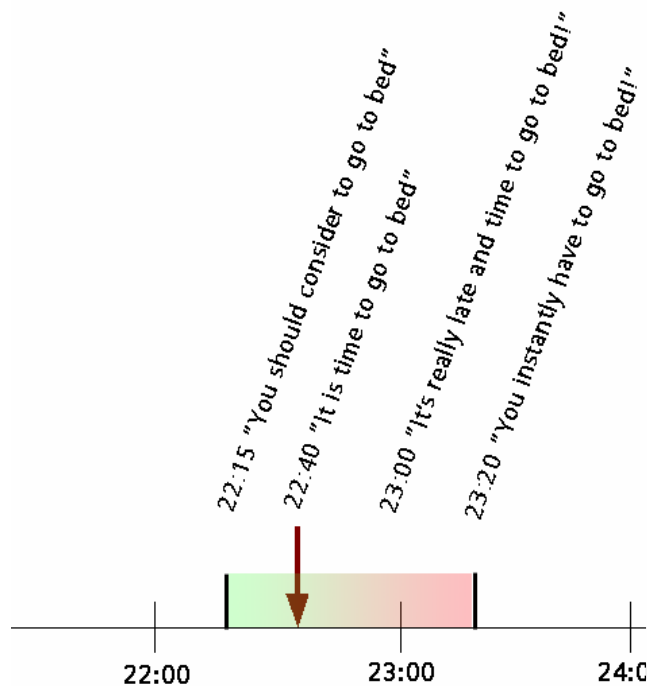


Figure 4: Flexible Reminder with different notification resources

Traditional alarm clock events (even those produced by electronic reminder or calendar systems) would store a one-time occurrence at 22:40 o'clock with an associated notification text like *"It is time to go to bed!"* to remind the user that it is bedtime now. In addition to this 'optimal occurrence time' this reminder is extended by the interval between a quarter past ten and twenty minutes past eleven. Depending on the real occurrence of the notification event (which is automatically calculated and generated by the Activity management modules) different notification resources may be used (see figure 4):

- From 22:15 o'clock to 22:40 o'clock (the time before the optimal occurrence) the system responds with *"You should consider to go to bed now (even if it is a few minutes earlier than usual)!"*
- From 22:40 o'clock until eleven o'clock the system responds with the standard notification text *"It is time to go to bed now!"*.
- After eleven o'clock until shortly before the reminder interval end the system responds with a more forcing text like *"It is really late you should go to bed now!"*
- At the latest possible event time, which is the closing bracket of the reminder interval, the system uses a final notification text like *"You instantly have to go to bed!"*

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*to bed now!*".

The usage of Flexible Reminders requires a generalized mathematical formulation of time events and the possibility to define algebraic structures on times of occurrences as already shown for one time occurrences in [12],[13],[14]. The “calendar algebra” is extended with respect to the needs of Flexible Reminders. More detailed information about the concept of Flexible Reminders, its usage, algebraic formulation and solution processes using linear optimization methods will given in the i2home deliverable “D7.2 - Specification Activity Management System”. For now, with the knowledge of the basic idea of Flexible Reminders some scenarios are pointed out, that will be used for the i2home second phase demonstrator.

Suitable adaptations, modifications and extensions for the usage of Flexible Reminders are proposed for the following three scenarios:

- Scenario “Manuela at home”
- Scenario “Blanka's Day”
- Scenario “Mrs. Eva Grün”

## 2.1. Scenario: Manuela at home

### 2.1.1. Scenario Purpose

This scenario is an adaptation and extension of the INGEMA scenario 1 described in “D1.3 – Scenario Description Report” [20]. Its purpose is to demonstrate the interaction of a person diagnosed with a mild to moderate Alzheimer's Disease with the i2home system using the television and a simple remote control for interaction. For notifications of the system to the user an avatar is used, which is streamed to the television at notification time.

### 2.1.2. Target Group

This scenario is targeted to the user group represented by the Manuela persona. Manuela is 73 years old and she lives with one of her daughters, María, who works as secretary, so she works shifts and has to spend time away. Ms. Manuela started suffering from Alzheimer's Disease 3 years ago, and she is still able to prepare simple meals (if she has the ingredients ready) as well as complete simple housekeeping tasks under supervision. She has been attending a Day Center since last month because it was very difficult for her to spend the day alone at home without help and supervision. Due to the fact that Manuela switches on the television directly after waking up and that the TV stays on the whole day, even if Manuela is not watching, the use of a personalized avatar as mean of communication of events to the user is a logical step.

### 2.1.3. Scenario Snippets

The following scenario fragments are used for the complete scenario depending on the current situation of the user (here Manuela). Due to the nature of the concept of Flexible Reminders the system has to respond in different ways depending on the current situation. All these scenario snippet are possible combinations of just up to three different events that occur at the end of Manuela's day:

- Manuela is watching TV (while the program she is watching is know for the i2home system by retrieving EPG (Electronic Program Guide) information.
  - Remind Manuela to go to bed.
  - Remind Manuela to take medication .
1. In the evening Manuela is watching an interesting movie, which is (according to the Electronic Program Guide (EPG) data starting at nine o'clock and ending at twenty minutes past ten. Manuela's personal profile includes an automatic flexible reminder to go to bed at ten o'clock with interval boundaries at 21:45 and 22:30 at latest. According to the knowledge of the i2home system that Manuela is currently watching this movie, the avatar will not appear at the optimal occurrence time of ten o'clock reminding her to go to bed, but waiting until the end the movie. Now at twenty minutes past ten the avatar appears reminding her that it is time to go to bed now.
  2. Unfortunately, Maria, who is responsible to create reminders for Manuela has scheduled two events at the same time. Both events, e.g. a reminder to take medication and a reminder to go to bed are set to ten o'clock in the evening. The relation between both events is defined so that medication should happen

prior to bedtime. Therefore, the system decides either to remind Manuela

- to take the pills at ten o'clock and directly after confirmation or five minutes later at most to remind her to go to bed or
  - to take her pills at five minutes before ten and to go to bed at ten o'clock.
3. In the evening Manuela is watching a movie on television which is ending ten minutes before ten. Although, the optimal occurrence of the reminder to go to bed is set to ten o'clock, the system will remind her directly after the ending of the movie that the time to go to bed is near and that she should consider to go to bed a few minutes earlier today.
  4. At half past nine in the evening Manuela is beginning to watch a movie, which will end late after eleven o'clock. Due to the fact, that the latest possible time for an 'go-to-bed'-notification is set to half past ten, the system will remind her, that she will not be able to finish this movie and ask her at least to confirm that she anyhow will start watching this movie.

There are a lot of further possibilities and combinations that could appear using these three events only at the end of Manuela's day. Especially, if further events are added that share the same occurrence intervals and no 'acceptable' solutions can be found by the system, the notification of the remaining event will occur at the latest possible time (the left side of the given occurrence interval), but always taking into account, that two notifications at the exact same time are not possible and both will be handled one after the other, even if a 'small' violation of the given reminder intervals is necessary.

## 2.2. Scenario Blanka's day

### 2.2.1. Scenario Purpose

This scenario is an adaptation and extension of the CTU scenario 1 described in “D1.3 – Scenario Description Report” [20]. Its purpose is to demonstrate the interaction of a novice user of computing equipment with the appliances in the user’s household as envisioned in the project i2home..

### 2.2.2. Target Group

This scenario is targeted to the user group represented by Blanka persona. Blanka is 73 living alone in a one-room apartment in Prague close to her daughter Jiřina who takes care of her and visits her every other day. Blanka likes watching TV. In her age, she has to take various medications but sometimes she can’t remember if she has already taken them or not. The apartment is equipped with state of the art electronic devices integrated into a home network with a central control unit, the Universal Control Hub (UCH). She uses a PDA as her personal controller.

### 2.2.3. Scenario Description

The following scenario fragments are used for the entire scenario depending on the current situation of the user (here: Blanka). Due to the nature of the concept of Flexible Reminders the system has to respond in different ways depending on the current situation.

1. In the original scenario description of D1.3 Blanka is reminded by the system at given time to take her medication. Five minutes later the system asks her whether she really took the medication. If the system does not receive her confirmation, the alarm tone will be more and more insisting. After 20 minutes without confirmation an SMS is send to her care giver Jiřina. This scenario part describes a typical set and chain of atomic events that directly depend on each other and where the possibilities of flexible reminders is nearly impossible. This concept of depending event will be explained in the following chapters of this document. Nevertheless, the start time of the event queue should altogether be handled flexible. Therefore, the start time of the first event of the chain (the first notification to take the pills) is set to flexible reminder with an interval of 15 minutes before and up to 45 minutes after the optimal notification time. If for example Blanka is currently cooking, which is known to the i2home system by realising that the oven and/or the extraction hood is still switched on, the medication reminder should be postponed to a starting time after finishing cooking. This is automatically handled due to the fact that for the events 'cooking' and 'taking medication' different levels of importance are predefined. The possibility to associate different sets of levels to events will be explained in the following chapter 'event-relational Algebra'. For this scenario it should be obvious that 'cooking' has a higher importance factor than 'taking medication' due to the fact that it is more dangerous to the health and life of the user to forget to switch of the running cooker than to forget o take the medication. The same example would be an event such as ironing (assuming that the system is able to recognise the status of the flat-iron), because here the interruption by the medication reminder could lead to a serious accident by forgetting to go back to the ironing event and therefore increase the possibility of a life threatening fire. On the other hand, an event

like the visit of friends in the afternoon for coffee or tea, which could be indicated by a calendar entry and possibly by the adequately ringing door bell, will be predefined with a notable lower priority, so that the reminder of taking the medication will happen at the given optimal time of this flexible reminder.

2. Another event of Blanka's day is the visit of her daughter (and caregiver) Jiřina at six o'clock in the evening. The signal of the door bell is propagated on the running TV screen in the form that the avatar notifies her that someone is coming. Blanka knows that Jiřina has a key for her flat and so she just waits until Jiřina comes in. This example tailor-made to demonstrate the concept of Flexible Reminders, because no one would assume that Jiřina will ring the door bell at exactly six o'clock but would expect that Jiřina is arriving within a time interval of for example twenty minutes. Due to the fact that Jiřina is coming directly from work, most of the visiting days she is rather ten minutes late than a few minutes early. From the point of view of the Activity Management this would lead to a calendar entry of an interval starting at ten minutes to six and ending at twenty minutes past six without an explicit notification. If the door bell is ringing within this time span the system could notify her with the avatar text 'The bell is ringing. This is probably Jiřina' or from five minutes before to ten minutes past six with 'This is most probably your daughter'. If the door bell is ringing at a time outside of the visit event, the system would react with the avatar speaking a sentence like "The door bell is ringing, but there is no visit planned for now".

## **2.3. Scenario: Mrs. Eva Grün**

### **2.3.1. Scenario Purpose**

This scenario is an adaptation and extension of the SIS scenario 1 described in “D1.3 – Scenario Description Report” [20]. Its purpose is to demonstrate the interaction of a partially-sighted user with the appliances in the user’s household as envisioned in the i2home project.

### **2.3.2. Target Group**

This scenario is targeted to the user group represented by the persona of Mrs. Grün. She is partially sighted since her childhood. She lives single in an apartment in a home for the elderly that is specialized in visually impaired people. Favorite activities of Mrs. Grün are cooking, watching TV, and listening to talking books with her DAISY player. The apartment is equipped with state of the art electronic devices integrated into a home network with a central control unit, the Universal Control Hub (UCH). She uses a PDA with touch-sensitive screen and speech-output as her personal controller.

### **2.3.3. Scenario Description**

The following scenario fragments are used for the entire scenario depending on the current situation of Mrs Grün. Due to the nature of the concept of Flexible Reminders only a few scenario fragments that put themselves forward the use of Flexible Reminders are extended or changed:

1. Mrs. Grün intends to go on train to visit her daughter. So when returning home from a doctor's visit and having short lunch she starts to prepare the visit. This part of the scenario contains two different events that in daily life could easily collide. Especially, visiting a medical doctor often goes with a significant delay in the doctor's office. On the other hand the preparation of the journey (including for example the packing of the bag) is of lower priority with respect to the starting time, if the journey actually starts one day later only. Therefore, instead of entering a rigid reminder at some time in the afternoon a Flexible Reminder with an extremely long interval of several hours (e.g. starting at eleven o'clock in the late morning and ending at eight o'clock in the evening) is used. This ensures that the reminder to prepare the journey will not occur during the delayed visit of the doctor or during her way back home but at a reasonable time in the afternoon. Whenever Mrs. Grün is coming back home (e.g. realised by the system by the manually changing status of any connected household device) she is notified by the i2home system to prepare her journey.
2. At the doctor's office Mrs. Grün get prescribed new pharmaceuticals, which she has to take in due time. For this purpose she uses her PDA to update her medication agenda (optional it would be thinkable that the doctor himself takes this part by using the caregiver's interface). This is an example that the parameters of Flexible Reminders should be optional input. Eventually, both Mrs. Grün and the doctor aren't familiar enough with the parameter settings. The doctor, because he is not using the i2home system every day and Mrs Grün because due to her age and disability her interface is not providing all possible parameters during setting up reminders. Therefore, the medication will be entered the easiest possible way by specifying a daily time and a notification text. Typical parameters used for medication purposes will be



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added automatically by the system and may be changed by the individual caregiver later on, if necessary or desired.

## 3. Event-relational Algebra

The scenario examples described in the previous chapter showed that events often directly depend on each other and that they can't be correctly interpreted and handled, if the dependences of these event are not clearly declared. An Activity Management system that assists the user and the caregiver in a meaningful way in their daily life has to be aware of various different logical dependences. Nevertheless, it is obvious that the users of the system are not able to specify all dependences between all existing events manually. Due to the rapidly increasing amount of possible connections even for very few events, this would be not only a difficult but an impossible task. Therefore, it is important that some key parameters can be defined for each new event (or even be automatically set by the system depending on the user's individual context), that allow an automatic calculation and comparison of events. To achieve this, an event-relational algebra is introduced, which ensures that describe the relationship of two or more events in a global way. Research have been already conducted especially with respect to time-driven relationships of events and notification services [15],[16],[17],[18],[19]. Nevertheless, the needs of the i2home scenarios demand on an extension with respect to time-based and priority-based relations.

### 3.1. Time-based relations

Time-based relations between events reflect the possibility to model that one event should occur after another. Especially, the concept of Flexible Reminder has to be taken into account for a clear formulation of the algebra. Typical relations and their interpretation with respect to interval-based time-events are:

- $A < B$  The interval of event A ends before the beginning of interval B
- $A > B$  The start of interval A is located completely after the end of B
- $A \leq B$  A starts before B but ends within the boundaries of B
- $A \geq B$  A starts within the interval limits of B but ends after B
- $A \subset B$  A is completely included in the boundaries of B
- $x \in A$  Time of occurrence x lies in the interval boundaries of event A
- $x \in A \cup B$  Time of occurrence x is part of interval A (inclusive) *or* interval B
- $x \in A \cap B$  Time of occurrence x is part of interval A *and* interval B

Further relations and algebraic properties such as associative and commutative operations, complement construction and ordered pairs of events will be introduced and motivated in detail in the i2home deliverable "D7.2 – Activity Management System".

### 3.2. Priority-based relations

Priority-based relations reflect the general relationship of two or more events. Priority parameters are set for each event as floating values to ensure an easy comparison of the events. Due to the fact that it is possible that the priority of a single event is changing during its life-time several different values can be set for the beginning, ending or intermediate points of the event. For a forgetful person for example the event of doing some ironing would be of normal priority in day-to-day life. But immediately after starting ironing this event has to become of maximum priority due to the fact that if the user is distracted by any other

event, the risk of forgetting the still turned on flat-iron and therefore the possibility of a fire increases significantly.

A detailed view on the event-relational algebra, its formulation and implementation will be given detailed in the i2home deliverable “D7.2 – Activity Management System“.

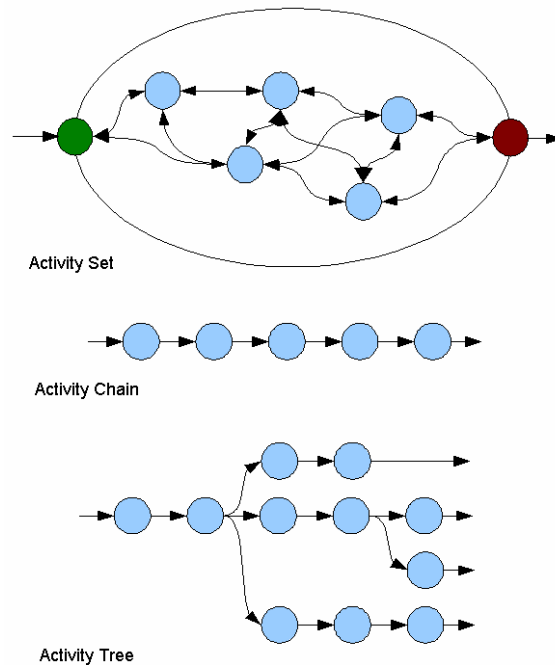


Figure 5: Activity Set (top), Chain (middle) and Tree (bottom)

### 3.3. Activity Sets, Chains and Trees

Sets, chains and trees of events and activities are specialisations of the event-relational view of the system with predefined relations as described in the previous chapter. Although they can be created and handled using the parameters of depending events directly, they are described here in a separate chapter, because of the following reasons:

1. They are important and often used methods to model typical daily tasks and
2. They are much easier to model than setting various parameters of single events.

Especially the second point is of high importance to allow an easy and intuitive interface to both the user and the caregiver, because all events of a task can be modeled in a graphical way and the corresponding parameters are then calculated and set by the system automatically (see figure 5).

### 3.4. Activity Sets

Activity Sets are a number of single events that are necessary to complete a complex task without considering the sequence order of the events. All events of a Activity Set are independent from each other with respect to the time and importance factors but have to be done to complete the task as a whole. A typical example for such a event set is the preparation of a journey: Various tasks like packing the bags, cancelling appointments and asking a friend or neighbour to take care of the flowers have to be done before leaving the home. Nevertheless, the order of the single task to completed is does not matter.

### 3.5. Activity Chains

Activity Chains are a number of single events with a clearly predefined processing order. Each event is directly depending on the outcome of the previous event with respect to its importance factor. Put another way this means that to complete a task one event has to occur after the other without exception. A typical example is the chain of activities that have to be done if the user is leaving his/her home. First the light has to switched off, after that (and leaving the flat) the door has to be locked and finally the alarm system has to be activated. A disorder of these events would result e.g. in an unwished alarm of the burglar alarm system. It is obvious that each single event of an event chain needs an explicit acknowledgement of the previous event.

### 3.6. Activity Trees

Activity Trees are combinations of Activity Chains with different predefined branching points. Colloquially spoken, Activity Trees are chains of events interrupted by 'if...then...else' conditions. Here, the continuation of a complex task directly depends on the result of a single event. Typical examples of Activity Trees are escalations plans: If an event that needs explicit acknowledgement is not confirmed, the user is reminded again. If he/she confirms the task to be done, a informational email is send to the caregiver. If the user's confirmation fails to appear, a second reminder event is created with a more insisting notification resource. If even this reminder is not confirmed, and SMS is send to the caregiver claiming intervention to solve the problem.

Note:

Due to the concept it is possible to combine the three types activity tasks described above and replace for example one branch of an Activity Tree with an appropriate Activity Set or on the other hand define a complete Activity Chain as one single node within an Activity Set (see also e.g. section 3.11: Scenario Mrs. Eva Grün).

### 3.7. Scenario: Blanka's day

In addition to the Flexible Reminders shown in the scenario description above, the following fragments complete the scenario of Blanka's day with respect to the Activity Management:

1. Blanka's alarm clock goes off at eleven o'clock. If she does not get up and does not acknowledge the alarm she will be reminded five minutes later with a more insistent wake up call. If she even now does not react with an acknowledgement a SMS will be sent to her caregiver Jiřina. If she presses the snooze button of the alarm clock interface, the wake up reminder will be postponed and will occur again five minutes later. Here again the system will wait for acknowledgement, will increase the emphasis five minutes later if necessary and finally will send a SMS to Jiřina if still no confirmation is received.
2. Blanka is reminded at some time (set by the optimisation of the Flexible Reminders) to take her medication. If she confirms this within the next five minutes a confirmation email is sent to Jiřina. If she does not confirm the reminder within the given time span, she will be notified with a more insistent notification resource. If still this confirmation will not occur in the next five minutes, a SMS will be sent to her caregiver.
3. If Blanka starts cooking and switches on the stove a predefined (and time-independent) Activity Chain automatically switches on the extraction hood.
4. Jiřina adds a new and time-independent Activity Chain when Blanka tells her that she is afraid of the burglars ringing at her door by triggering an automatic SMS sent to her mobile phone on each door opening.

## 3.8. Scenario: Arnošt leaves home for shopping

### 3.8.1. Scenario Purpose

This scenario is an adaptation and extension of the CTU scenario 2 described in “D1.3 – Scenario Description Report” [20]. Its purpose is to demonstrate the interaction of a advanced user of computing equipment with the appliances in the user’s household as envisioned in the project i2home.

### 3.8.2. Target Group

This scenario is targeted to the user group represented by the Arnošt persona. Arnošt is 68 and living with his wife in flat in Prague. Due to the fact that he is a skilled computer user, he is able to operate the i2home system by himself and to use a PDA as a personal controller.

### 3.8.3. Scenario Description

The following scenario fragments explain those parts of the original scenario description that are handled by Activity Management with respect to the Event-relational Algebra:

1. A personalised Activity Chain is used to ensure that after switching off the alarm clock the HVAC is automatically notified by the system to switch the device from “night“ to “morning“ mode. This event occurs only if Arnošt really switches off the alarm clock, but not if he is pressing a snooze button on his controller as described in the previous scenario.
2. To assist Arnošt in cooking coffee in the morning or any other task, which uses technical devices of the kitchen integrated into the i2home system, a bunch of user-related and user-independent rules is stored in the Activity Management. In this scenario an Activity Chain is used, that automatically switched on the extraction hood as soon as the water is cooking.
3. After breakfast Arnošt is watching TV. This is an example of a user-related activity due to the fact that in Arnošt personal profile of the i2home system the BBC New channel is predefined as his favorite channel in the morning. Therefore, when he is switching on the television in the morning, the TV will automatically be set to this channel.
4. Arnošt is reminded by the system to take his medication. In the original scenario description Arnošt acknowledges this on his controller and continue his doings. This task is modeled by an Activity Tree to ensure an appropriate reaction of the system even if Arnošt does not confirm the notification. Due to the fact that Arnošt does not need a caregiver the typical escalation plan is partially used only. The task tree does not include the final escalation notifications by sending an email or a SMS. Instead of this, the count of possible reminders, if he does not confirm that he has taken his pills, is extended from predefined two additional notifications with more insisting reminder resources to four additional notification. Supposing that all these reminders are not acknowledged, the Activity Management system will create a last reminder set e.g. a few hours later in the afternoon.
5. If both Arnošt and his wife are leaving the flat, he is using his controller to set the i2home system into the “nobody at home“ mode. This task is modeled by an Activity Set with several smaller tasks that are independent from each



other, but have to be complete to realise the status as a whole. In this scenario the remotely set “nobody at home“ event will simultaneously switch of all running devices like HVAC, television and radio and will set the light controller to a random mode. All devices are afterwards checked by the Activity Management System and in case of a malfunction of one of the devices an notification is send to Arnošt's controller.

### 3.9. Scenario: Manuela at home

In addition to the Flexible Reminders shown in the scenario description above, the following fragments complete the scenario of Manuela's day with respect to the Activity Management:

1. Manuela is missing her favorite program, because the television is not set to the right channel. An avatar appears on the TV asking her if she wants to watch her favorite program. This task is extended and modeled by an Activity Tree. If the TV is set to the right channel, the avatar appears only reminding Manuela, that the program start right now. If the TV is set to the wrong channel, the avatar appear a few minutes earlier to remind her of her favorite program and asking her, if she wants to see it. If she is confirming this question with 'yes', the TV will automatically set to the right channel, the individually stored preferred volume settings will be set and the light is automatically dimmed to an appropriate value. If she confirms the question with 'no', the avatar disappears and no further system reaction is provided for this task. If Manuela does not react on the avatar's question at all, a new and more insisting reminder is set one minute later. Nevertheless, due to the fact that watching TV is an event with a lower priority, no escalation plan is initiated for this task if even the second reminder is not acknowledged.
2. In contrast to point 1 an escalation planned realized by a predefined Activity Tree is necessary for the notification to take medication. At ten o'clock the avatar appears on the television reminding Manuela to take the blue pills. If she confirms this by pressing the correct button on her remote control within the next five minutes a SMS is sent to her daughter Jiřina. If she does not acknowledge the medication she will be reminded by the avatar a second and a third time in intervals of five minutes each and with increasingly insisting notification texts spoken by the automatically appearing avatar. In contrast to the first reminder, which have been set very flexible with an possible interval of at least one hour around the optimal notification time, the second and third notification will not have consideration for the interruption of the running TV program. If even the third reminder is not acknowledged, a SMS is send to Jiřina to confirm this fact.
3. Due to security reasons the HVAC is locked for Manuela. Nevertheless, Jiřina is able to set the device to a "save energy mode" if nobody is at home. This original part of the scenario is extended to an overall Activity Set, which is used to switch off or to change the mode of all relevant devices. An set of events that are independent from each other is used to change all device statuses accordingly. Beside the HVAC other affected devices in Manuela's home are controlled automatically like the television, devices located in the kitchen or even the light of the flat.

## **3.10. Scenario: Emma, an ordinary day**

### **3.10.1. Scenario Purpose**

This scenario is an adaptation and extension of the HI scenario described in “D1.3 – Scenario Description Report” [20]. Its purpose is to demonstrate the interaction of a user with mild to moderate cognitive disabilities with the appliances in the user’s household as envisioned in the project i2home.

### **3.10.2. Target Group**

This scenario is targeted to the user group represented by the Emma persona. Emma is 25 year old girl living in Stockholm with her boy friend. After rehabilitation of a serious car accident she continued her studies of art on a half time.

### **3.10.3. Scenario Description**

The following scenario fragments explain those parts of the original scenario description that are handled by Activity Management with respect to the Event-relational Algebra:

1. Emma uses a PDA as the only controller device. She is using the PDA to directly control the connected output devices and as a personal reminder system. In the original scenario description Emma e.g. realises that she is in a hurry when she receives a reminder on her PDA. She is leaving home forgetting to switch off the iron and to close the main door of the flat and has to run back home. To avoid such problems the reminders for Emma are extended to personalized Activity Chain. Reminder events are starting at an appropriate time before the task has to be effectively performed. Emma has to acknowledge these notifications by pressing a button on her PDA interface. But even the explicit acknowledgement leads to repetitive reminders some minutes later. In the case of forgetting to switch off running devices when leaving home, the Activity Chain will be adapted in such a way that Emma will get three reminders that she will have to leave her flat and at this time, eventually running devices will automatically switched off. Of course, in rare cases Emma may decide despite of her appointment not to leave and will get angry because some devices will automatically be switched off. Nevertheless, if this happens, she switches on the devices again manually knowing that in most of cases she can be sure that no accident happens if she is not at home.
2. In the morning Emma goes into the bathroom to take a shower. While showering she receives information about how long she has showered. This task is realised as an Activity Chain. As she starts to shower (e.g. indicated by pressing an appropriate button on her controller before entering the shower) an event queue is started that will produce notifications after five, seven and nine minutes that need not to be acknowledged. After the designated maximum time of nine minutes, every minute a new reminder is generated notifying her to stop showering until she acknowledges that she has stopped showering.

### 3.11. Scenario: Mrs. Eva Grün

In addition to the Flexible Reminders shown in the scenario description in a previous chapter, the following fragments complete the scenario of Mrs. Grün's day with respect to the Activity Management:

1. After lunch Mrs. Grün starts to prepare the journey to visit her daughter. These preparations are modeled as an Activity Set of various single but independent tasks embedded in a simple Activity Chain. Mrs. Grün will first be reminded on her PDA to start the preparation for her journey. From now on various tasks like packing the bags, cancelling her appointments for the duration of the journey and asking a friend or neighbour to take care of the flowers have to be completed in an arbitrary order. During this time she will be able to check single tasks to be completed. Shortly before the journey starts, a new reminder is used to notify her to leave now in order not to miss the train. If eventually still a household device connected to the i2home system is still running, Mrs. Grün will be reminded to switch it off.
2. During her journey back home, returning from her daughter, Mrs. Grün uses her PDA to switch on the HVAC at her apartment. Shortly after these settings she receives an alarm message indicating that the condensation container of the device is full and has to be replaced. Here two possible implementations of this part of the scenario are possible: (1) If usually Mrs. Grün's caregiver is responsible for replacing the filter, the HVAC is automatically switched off and an SMS or email is send to her caregiver. Additionally she will be informed about this fact only. (2) If Mrs. Grün usually replaces the filter at her own, but the system realises that she is not at home, both Mrs. Grün and her caregiver are informed by an SMS that the filter is full and has to be replaced. Mrs. Grün may now use her mobile phone to call her home of the elderly to to arrange with her caregiver about the filter replacement.
3. A few days later Mrs. Grün is leaving her apartment to take a walk in the park. The designated system reaction has been already described in the original scenario description using an Activity Set embedded into an Activity Tree: Locking the main door indicated that nobody is at home. If one or more devices are still running, a reminder is send to her asking her if this is a long or a short leave. If she confirms a long leave the Activity Set to switch off all devices like HVAC, television and lights is activated. If she confirms a short leave only, the system will run another Activity Set, which is switching off the light and home entertainment devices but leaving the HVAC status unchanged.

## 4. Conclusion

In this document we have described the main concepts and possible scenarios for the i2home phase two demonstrators especially with respect to work package “WP7 – Activity Management”. The concepts of

- Activity-Aware Reminders,
- Event-relational Algebra and
- Activity Sets, Chains and Trees

have been elementary introduced and motivated. They will be described more detailed in the second deliverable of this work package “D7.2 – Specification, Activity Management System”. Scenarios described by the user oriented partners of the project in the i2home deliverable “D1.3 – Scenario Description” [20] have been fragmented and resulting scenario snippets have been associated to these concepts accordingly. Depending on the outcomes of the evaluations and user tests of the first and second phase i2home demonstrators, it is expected that the scenarios will be modified, adapted or extended later on for the third phase i2home demonstrators.

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