Design av brukergrensesnitt på mobile enheter

Tutorial på Yggdrasil
Lillehammer, 12 oktober 2009

Erik G. Nilsson
SINTEF IKT

YGGDRASIL | 2009

Agenda

13:15 Introduction, user interfaces on mobile equipment, important choices
13:30 Overview of the patterns collection

13:45 Introduction to exercise

14:00 Utilizing screen space - presentation
14:20 Screen space challenges in the exercise – including break
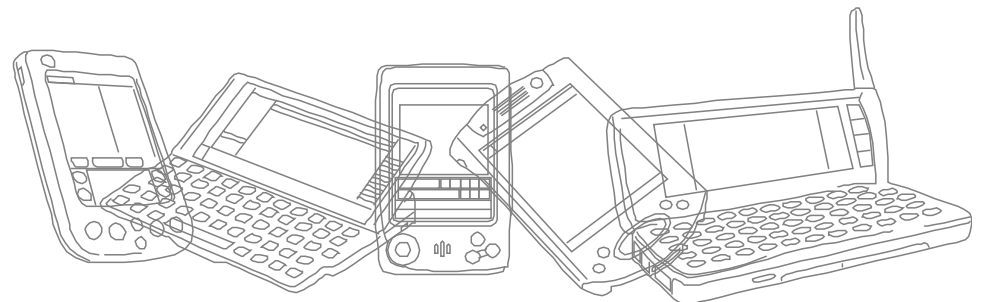
15:20 Interaction mechanisms - presentation
15:40 Interaction challenges in the exercise

16:25 Adaptive solutions
16:45 Adaptive features in the exercise

17:15 Finish
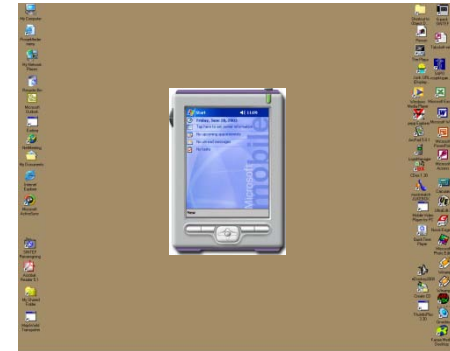
SINTEF

FLAMINCO and UMBRA projects

- UMBRA
    - Development of user friendly application on mobile devices
        - PDAs & SmartPhones
        - Design guidelines
        - Evaluation methods
    - Duration: 2004-2005
- FLAMINCO - FLexible Applications exploiting Multi modal INteraction and COntext
    - Address challenges when developing UI on mobile devices in the next years to come
    - Finding solutions to some of the major problems facing developers of future mobile solutions
        - handling layout in varying conditions
        - multi modal user interfaces
        - adaptive and context sensitive user interfaces
        - forms based user interfaces (including automatically generated ones)
    - Focus on user interface design
    - Addressed some challenges with regards to evaluation of mobile user interfaces
    - Duration: 2006-2008
- Both projects
    - User-driven innovation projects
    - Funded by the Norwegian Research Council
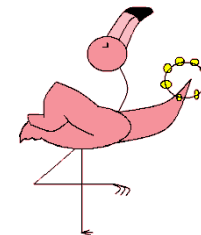
# Characteristics of User Interfaces on mobile devices

- **Screen size**
  - dialog on a small screen
  - impossible to have more than one dialog available at a time
  - important to design user interfaces that are highly adapted to the users' tasks

- **Interaction mechanisms are limited on mobile equipment**
  - keyboard is often missing (or is limited)
    - some designated HW buttons
  - mouse is missing or replaced with pen
  - differences are even largest on consumer market mobile phones

- **Limitations vs. opportunities**

SINTEF
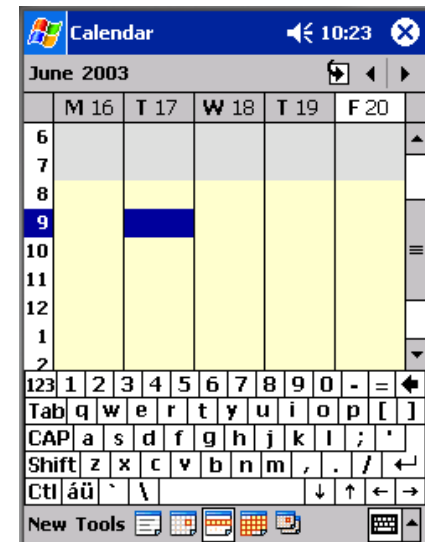
Important choices

- Type of device
  - PC
  - Tablet PC/UMPC
  - **PDA**
  - **Smart Phone**
- Platform
  - Linux (Android, Qtopia, …)
  - Mac OS X (iPhone/iPod Touch)
  - Palm
  - Symbian
  - Windows Mobile/Phone (PocketPC/WinCE)
- WUI vs. GUI (vs. terminal server)
  - Application working towards web service(s)
- Stand alone vs. server based vs. hybrid
- Transactions vs. information
  - Usually given from (part of) application
  - Different challenges
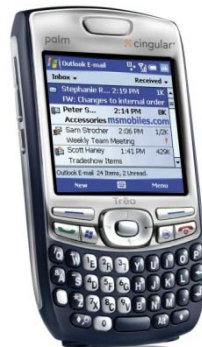
Agenda

13:15 Introduction, user interfaces on mobile equipment, important choices
13:30 Overview of the patterns collection

13:45 Introduction to exercise

14:00 Utilizing screen space - presentation
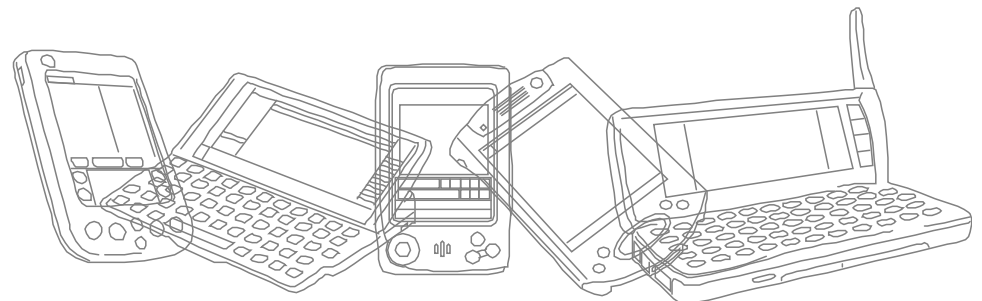14:20 Screen space challenges in the exercise – including break

15:20 Interaction mechanisms - presentation
15:40 Interaction challenges in the exercise
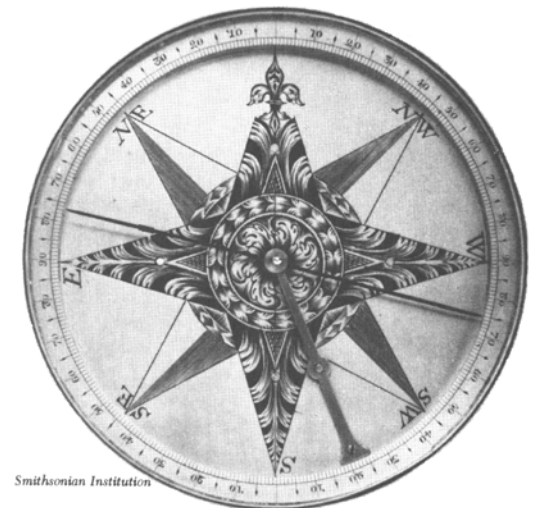
16:25 Adaptive solutions
16:45 Adaptive features in the exercise

17:15 Finish

Presentation structure for problems

- Main problem area (1-3)
  - Problem area (1-2)
    - Problem (1-n)
      - Description
      - More specific problem (0-p) or
      - General guidelines
      - Design pattern (0-q)
        - Description
        - Use when
        - How
        - Why

Smithsonian Institution

Main problem and Problem areas

- Utilizing screen space
  - Screen space in general
  - Flexible user interfaces
- Interaction mechanisms
  - Handling input
  - Not using the stylus
- Design at large
  - Guidelines
  - "Difficult to understand"
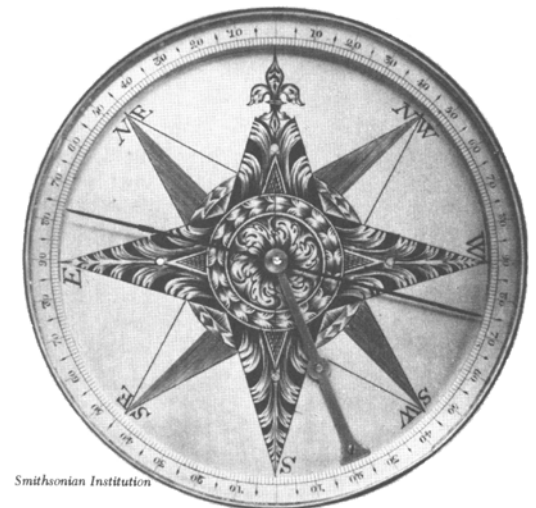
Smithsonian Institution

Utilizing screen space

- ■ Screen space in general
  - ■ Presenting elements in lists
    - ■ Space restrictions in lists
    - ■ Functionality in lists
    - ■ Presenting hierarchies in lists
  - ■ Principles for grouping information
    - ■ What should information be grouped according to?
  - ■ Mechanisms for grouping information
  - ■ Mechanisms for packing information
  - ■ Horizontal scrolling
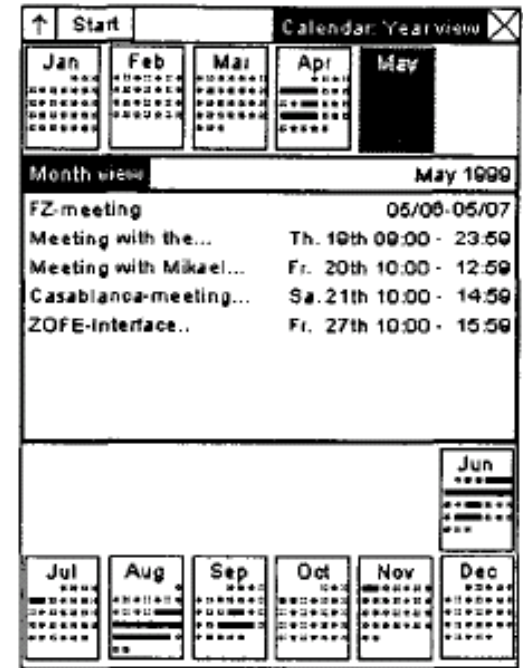
Utilizing screen space

- **Flexible user interfaces**
  - Presentation based on models – how to do this on a small screen
  - Presentation based on data – how to do this on a small screen
  - Handling crowded dialogs when software keyboard is shown and hidden
  - User interfaces that facilitate switching between portrait and landscape mode
  - User interfaces that are able to run on equipment with different screen size
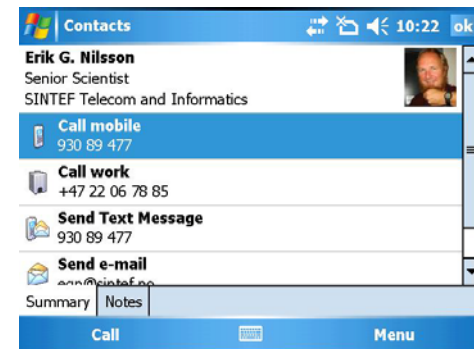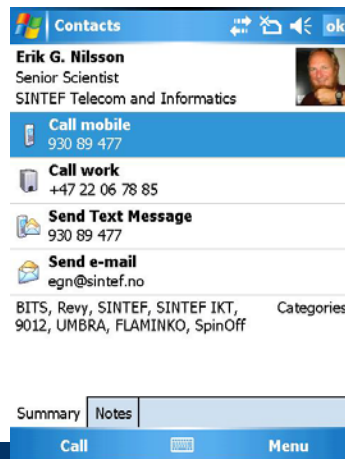
Interaction mechanisms

- **Handling input**
  - **Mechanisms for entering text**
    - Avoiding that the user has to type
    - Making typing easier
  - **Order entry**
    - Needs to be fast even if it contains large amounts of data and there are a number of rules

  - **Mechanisms for entering numerical data**
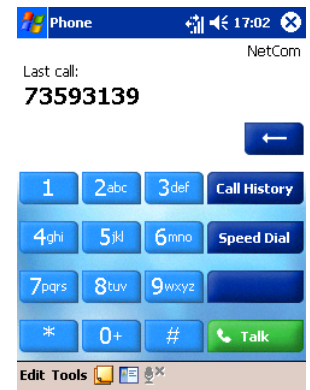 - **Multi modal interaction**
  - **Controlling the input cursor from an application**
- **Not using the stylus**
  - Interacting with applications without using stylus
  - Retrieving data from a database without using keyboard

Design at large

- **Guidelines**
  - Design that supports branding, is aesthetic, and utilize screen space optimally
  - Searching large amounts of data
    - E.g. multi-step solutions
  - Visually coding of entry fields to mark editability
    - Must, may, may not
  - Conformance to standards
  - Use standard solution or develop own
- **"Difficult to understand"**
  - Synchronization solutions
    - User interaction during synchronization
  - User interaction for log-on/log-off
  - User interaction during long-lasting operations
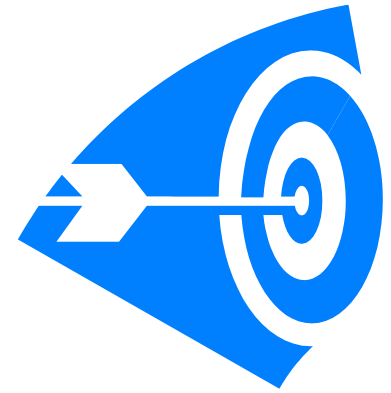
Agenda

13:15 Introduction, user interfaces on mobile equipment, important choices
13:30 Overview of the patterns collection

13:45 Introduction to exercise

14:00 Utilizing screen space - presentation
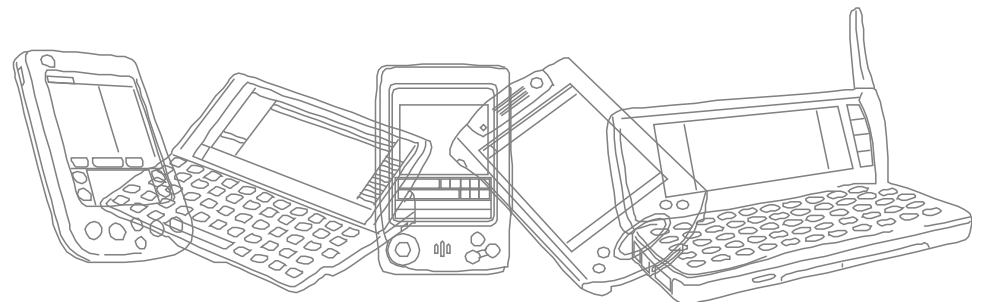14:20 Screen space challenges in the exercise – including break

15:20 Interaction mechanisms - presentation
15:40 Interaction challenges in the exercise

16:25 Adaptive solutions
16:45 Adaptive features in the exercise

17:15 Finish

Exercise - Shopping list

- **Users**
  - Anyone
    - No required knowledge of computer or mobile device use
   - Easy to learn
    - Easy to use
- **Context**
  - To run on modern smartphone
    - Touch screen
    - 3-4" screen with "decent" resolution
  - A PC based server solution for planning will be developed later, including synchronization etc.
  - The first version will be stand-alone
    - All tasks must be supported on the device

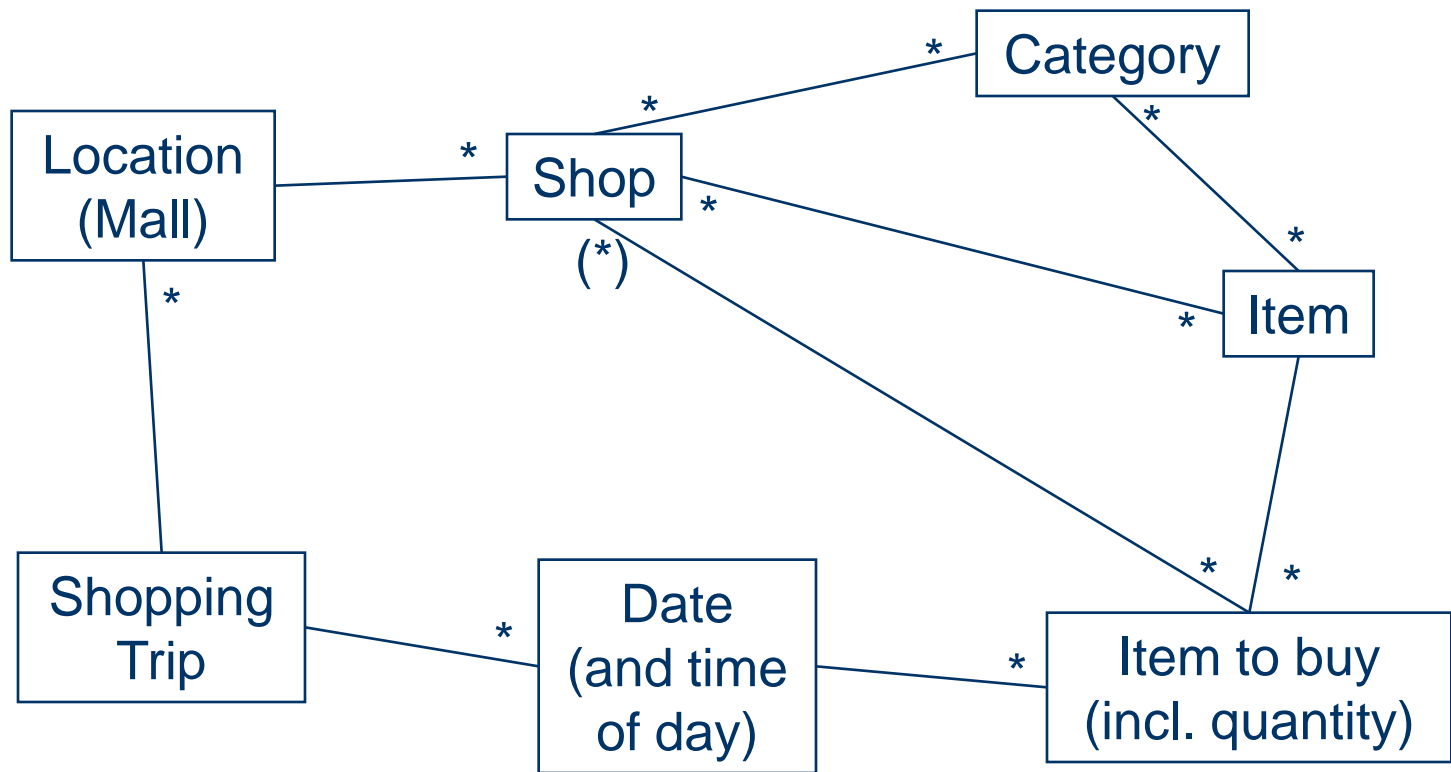# Exercise - Shopping list

- Tasks
  - Planning – usually performed "at home"
    - Plan what to buy and where to buy it
    - Planning for different dates
  - Shopping – usually performed "in the shop"
    - Tick off bought items
    - Supplement shopping lists
      - For this shopping trip
      - For other shopping trips
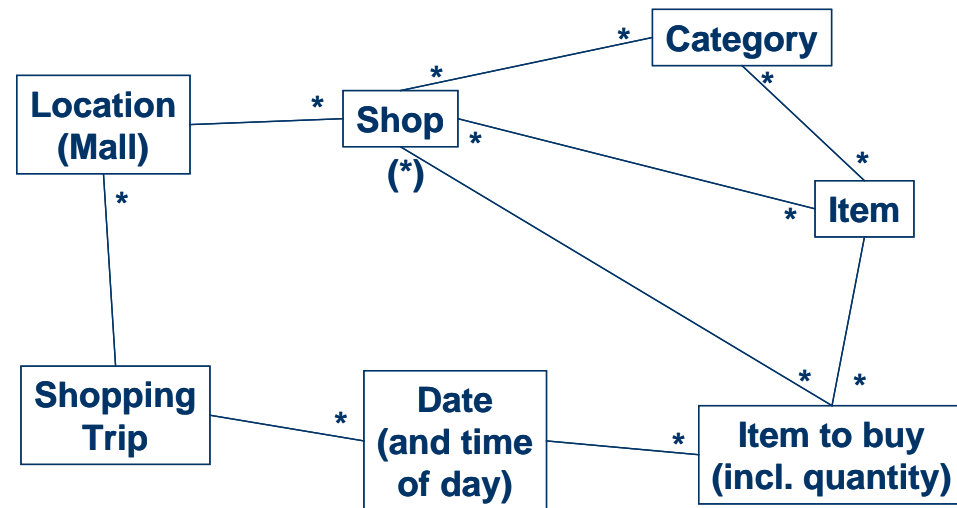   Today
        Other date
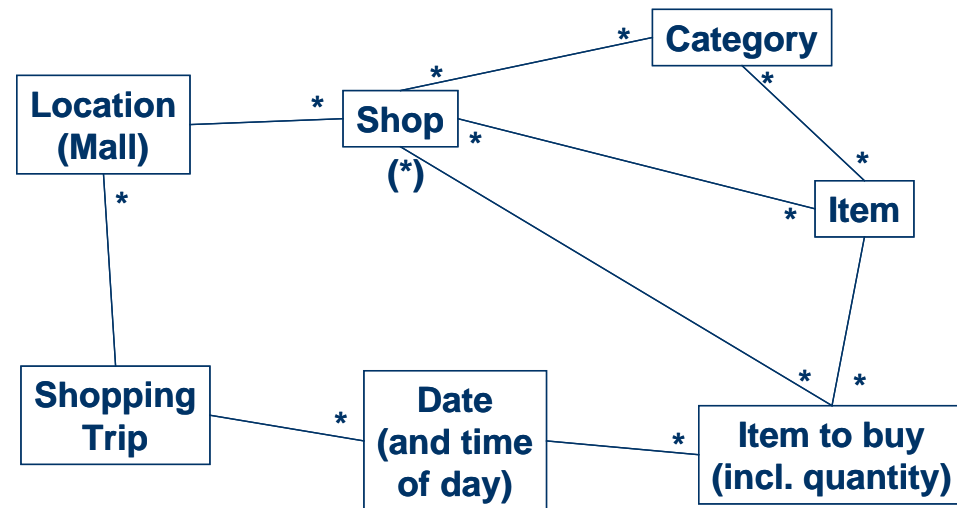
Exercise - Shopping list

- Conceptual model

Exercise - Shopping list

- **Important issues**
  - Item has quite a few attributes
  - Some attributes may be present both on Item and Item to buy
  - The system should "remember" all relevant data
    - Location
    - Shop
    - Category
    - Item
    - Shopping history?

```
Location                      *   Shop      *        * Category
(Mall)                    *              *                      *
                                      (*)              *        *
        *                                                *     Item
                                                         *      *
Shopping           *    Date                     *    *
Trip                    (and time          *    Item to buy
                        of day)                  (incl. quantity)
```

Agenda

13:15 Introduction, user interfaces on mobile equipment, important choices
13:30 Overview of the patterns collection

13:45 Introduction to exercise

14:00 Utilizing screen space - presentation
14:20 Screen space challenges in the exercise – including break
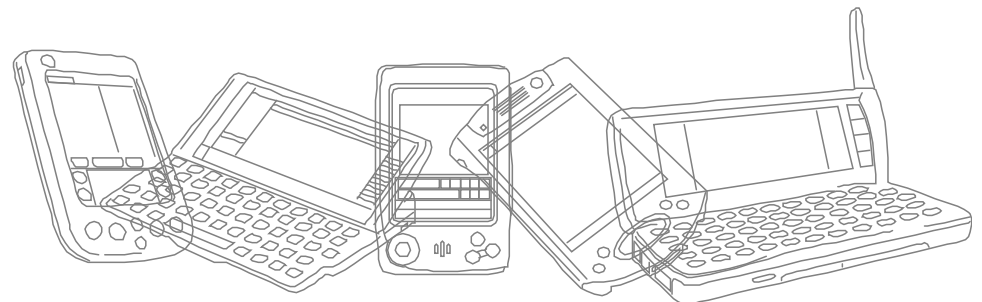
15:20 Interaction mechanisms - presentation
15:40 Interaction challenges in the exercise

16:25 Design at large & Adaptive solutions
16:45 Adaptive features in the exercise

17:15 Finish

Important challenges and solutions for utilizing screen space

- **Utilizing screen space**
  - Screen space in general
    - Presenting elements in lists
      - Space restrictions in lists
      - Functionality in lists
      - Presenting hierarchies in lists
    - Principles for grouping information
      - What should information be grouped according to?
    - **Mechanisms for grouping information**
    - Mechanisms for packing information
    - Horizontal scrolling
  - Flexible user interfaces
- **Interaction mechanisms**
- **Design at large**

Mechanisms for grouping information

- **Description**
  - **Needs for grouping**
  - **Principles**
    - Do not group
      - E.g. use scrolling
    - Levels of grouping
      - One
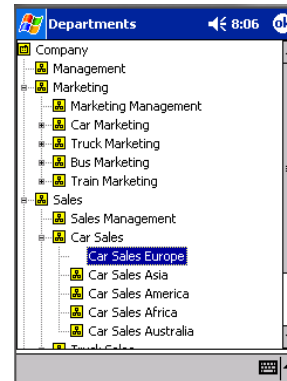   - More
  - **Number of levels / number of group per level**
  - **Grouping by "class"**
    vs.
  - **Grouping within "class"**
  - **Coupling to use**
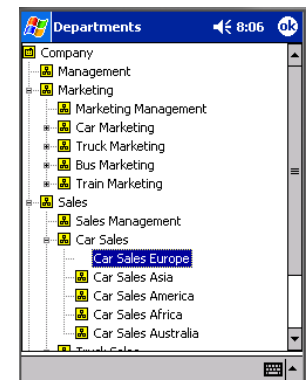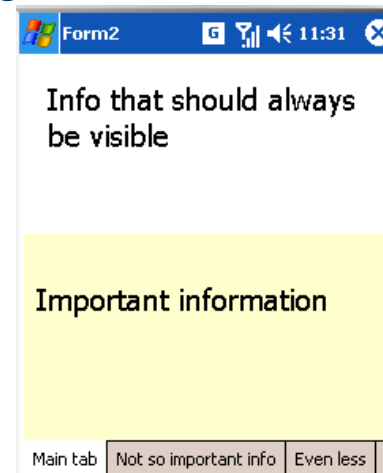   - Including frequency of use

Mechanisms for grouping information

- **Design Patterns**
  - Use tab folders for grouping
    - Template below
  - Let the user expand and collapse blocks of information
  - **Use different dialogs for grouping**
  - Use wizard for grouping
  - Use tree view control for grouping
- **General Guidelines**
  - Combination of mechanisms
  - Pros and cons of the patterns

Use different dialogs for grouping

- **Description**
  - Different dialogs with intuitive navigation as grouping mechanism
- **Use when**
  - Most situation
    - A need to present more information than will fit in one dialog and scrolling should be avoided
    - When it is not convenient to do editing in the same view as the information is presented
- **How**
  - Split info into categories
    - Presented in menu or list
  - Split into a set of connected screens
  - Editing in separate dialogs
  - Maintain the connection between the dialogs
    - Button placement
    - Button layout
    - Manipulation gestures
    - Animation
- **Why**
  - More room for presenting information in each dialog
  - Maintains less context information
  - Possible to edit fairly large number of attributes in dialogs that are not too crowded
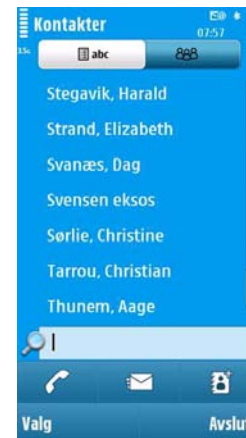
Important challenges and solutions for utilizing screen space

- **Utilizing screen space**
  - Screen space in general
  - Flexible user interfaces
    - Presentation based on models – how to do this on a small screen
    - Presentation based on data – how to do this on a small screen
    - **Handling crowded dialogs when software keyboard is shown and hidden**
    - User interfaces that facilitate switching between portrait and landscape mode
    - User interfaces that are able to run on equipment with different screen
- **Interaction mechanisms**
- **Design at large**

Handling crowded dialogs when software keyboard is shown and hidden

- **Description**
  - Touch screen devices
    - Mostly used on devices without keyboard
  - Available screen real estate vary at run time
    - View port resized
  - Resize dialog?
  - Different (importance) for different styles of UI
    - Form based
    - Graphic based
    - Repetition based
    - Document based
    - Icon based
  - Element with focus may disappear
    - Auto-scrolling
  - More difficult combined with flipping the screen
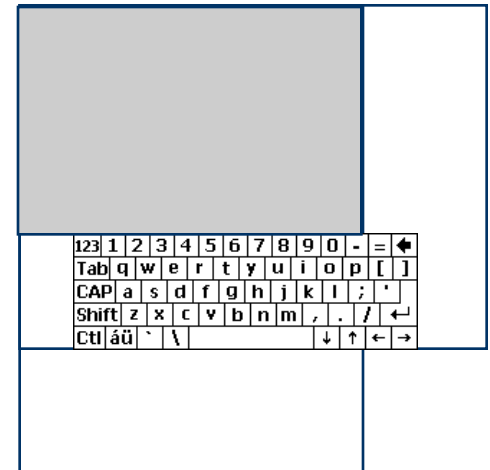
Handling crowded dialogs when software keyboard is shown and hidden

- **Design patterns**
  - Add or adjust scroll bars
  - Let the keyboard cover part of the UI
  - Only use the part of the screen that will not be covered by the keyboard
  - Use one large UI control as a buffer
  - **Include the keyboard as part of layout**
  - Use full screen keyboard
  - Have two variants
- **General guidelines**
  - Dynamic resizing

SINTEF
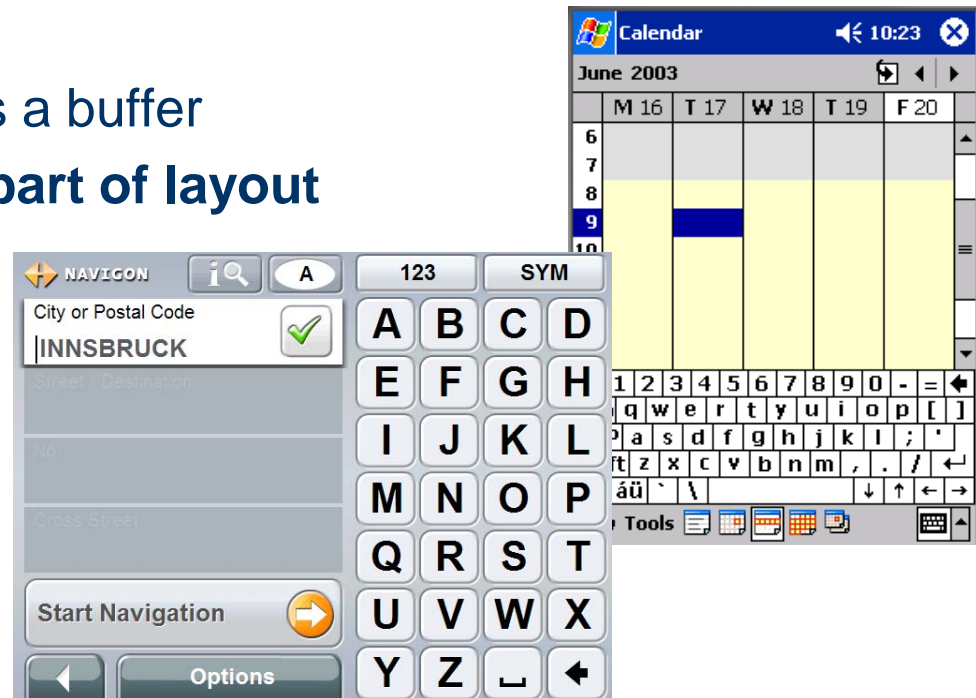
Include the keyboard as part of layout

- **Description**
  - Application specific keyboard that is designed to be part of the layout
- **Use when**
  - Mass market products
  - Supported by the OS
- **How**
  - Develop application specific keyboard
  - Solution is well supported by the development tools in iPhone
- **Why**
  - Efficient
  - User friendly
  - Finger-friendly
  - User may loose context information

Agenda

13:15 Introduction, user interfaces on mobile equipment, important choices
13:30 Overview of the patterns collection

13:45 Introduction to exercise

14:00 Utilizing screen sp...
14:20 Screen space challen... ...ise – including break

15:20 Interaction mechanism...
15:40 Interaction challe...

16:25 Adaptive solutions
16:45 Adaptive features in the exercise

17:15 Finish

Exercise - Shopping list

- **What are the main screen space challenges?**
    - Which tasks are most challenging?

- **Overall dialog structure**
    - Task or data oriented? (or something else)
    - Which dialogs are needed?
    - Navigation between dialogs

- **Challenging dialogs**
    - Grouping
    - Packing
    - Dynamic aspects?

Agenda

13:15 Introduction, user interfaces on mobile equipment, important choices
13:30 Overview of the patterns collection

13:45 Introduction to exercise

14:00 Utilizing screen space - presentation
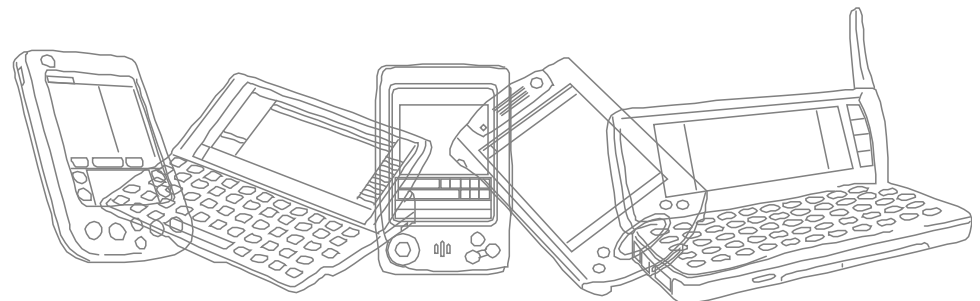14:20 Screen space challenges in the exercise – including break

15:20 Interaction mechanisms - presentation
15:40 Interaction challenges in the exercise

16:25 Design at large & Adaptive solutions
16:45 Adaptive features in the exercise

17:15 Finish

Important challenges and solutions for interaction mechanisms

- **Utilizing screen space**
- **Interaction mechanisms**
  - Handling input
    - Mechanisms for entering text
      - Avoiding that the user has to type
      - Making typing easier
    - Order entry
      - Needs to be fast even if it contains large amounts of data and there are a number of rules
    - Mechanisms for entering numerical data
    - **Multi modal interaction**
    - Controlling the input cursor from an application
  - Not using the stylus
- **Design at large**

Multi modal interaction

- **Description**
  - Goal: avoid typing
    - Pen, finger(s), bar code reader, RF-ID, Bluetooth, various keyboard, voice control, motion detectors
  - Multi modal
    - Alternative interaction mechanisms separately
    - Combination of alternative interaction mechanisms
  - Technological challenges
  - Requires specialized equipment
  - Maturity level
  - Efficiency
  - Avoiding errors
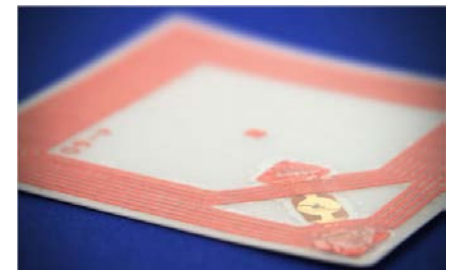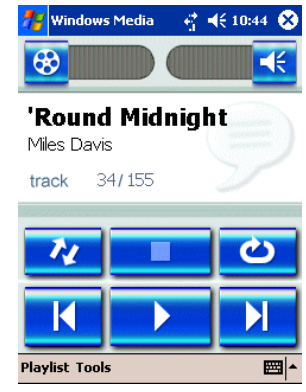
Multi modal interaction

- **General guidelines**
  - **Alternative modalities**
  - **Different suitability**
    - Stylus
    - Gestures
      - On screen
      - Using device
    - Hardware buttons
    - Hardware keyboard
    - Bar code reader
    - RF-ID based solutions
    - Camera
    - Voice control
    - Sensors
      - GPS
      - Compass
      - Accelerometer
      - Proximity sensor
  - **Modalities in parallel**
  - **UIs for controlling use of modalities**
  - **Automagic behaviour vs. user control**

Important challenges and solutions for interaction mechanisms

- **Utilizing screen space**

- **Interaction mechanisms**
  - Handling input
  - Not using the stylus
    - **Interacting with applications without using stylus**
    - Retrieving data from a database without using keyboard

- **Design at large**

Interacting with applications without using stylus

- **Description**
  - Touch screen devices
  - Hardware buttons
    - Special functions
    - Soft keys
    - Wheels / joy sticks / navigation pads
  - Generic support in UI controls
  - Some users / situations require finger control
    - Nails
    - Fingertip
    - Gloves
  - Pointing is coarser
  - Larger parts of the screen is covered by the hand
  - Increasing component size enhance screen space problems
  - Intuitive mapping of hardware buttons
  - May only be relevant for parts of an application

Interacting with applications without using stylus

- Design patterns
  - Finger friendly
    - Menu choices
    - Lists
    - ...
- General guidelines
  - Choose most appropriate UI components
  - Simple adaptation of UI components
  - Appropriateness and adaptation for finger navigation
    - For Windows Mobile UI controls
    - Table
  - Advanced adaptation of UI components
  - Develop custom UI controls
  - Gestures
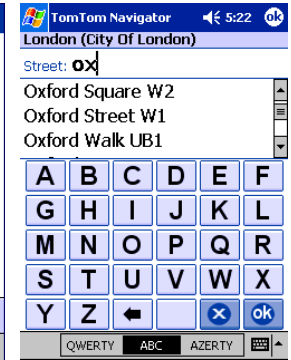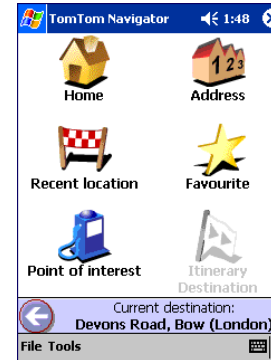
Agenda

13:15 Introduction, user interfaces on mobile equipment, important choices
13:30 Overview of the patterns collection

13:45 Introduction to exercise

14:00 Utilizing screen space - presentation
14:20 Screen space challenges in the exercise – including break

15:20 Interaction mechanisms - presentation
15:40 Interaction challenges in the exercise

16:25 Adaptive solutions
16:45 Adaptive features in the exercise

17:15 Finish

Exercise - Shopping list

- **What are the main interaction challenges?**
  - Which tasks are most challenging?
- **Typing intensive tasks**
  - How to avoid typing
  - Exploit domain knowledge?
  - Smart solutions
  - At home or in the shop?
- **Multi modal interaction?**
- **Use the stylus or not?**
  - Finger friendly
  - Gestures?

Location (Mall) — * — Shop (*) — * — Category

Shop * — * — Item

Location (Mall) * — Shopping Trip

Shopping Trip — * — Date (and time of day) — * — Item to buy (incl. quantity)

Item — * * — Item to buy (incl. quantity)

Agenda

13:15 Introduction, user interfaces on mobile equipment, important choices
13:30 Overview of the patterns collection

13:45 Introduction to exercise

14:00 Utilizing screen space - presentation
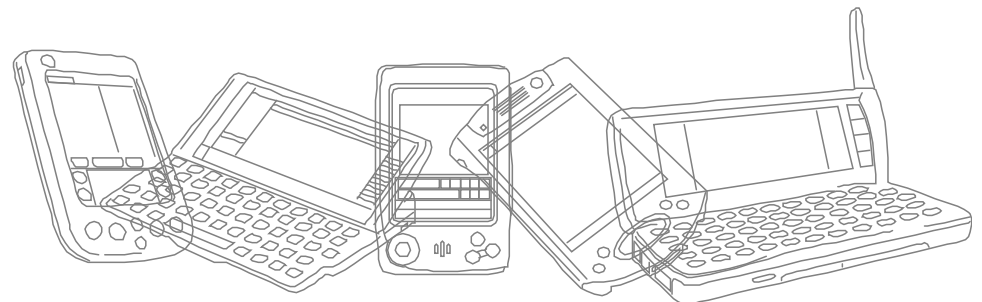14:20 Screen space challenges in the exercise – including break

15:20 Interaction mechanisms - presentation
15:40 Interaction challenges in the exercise
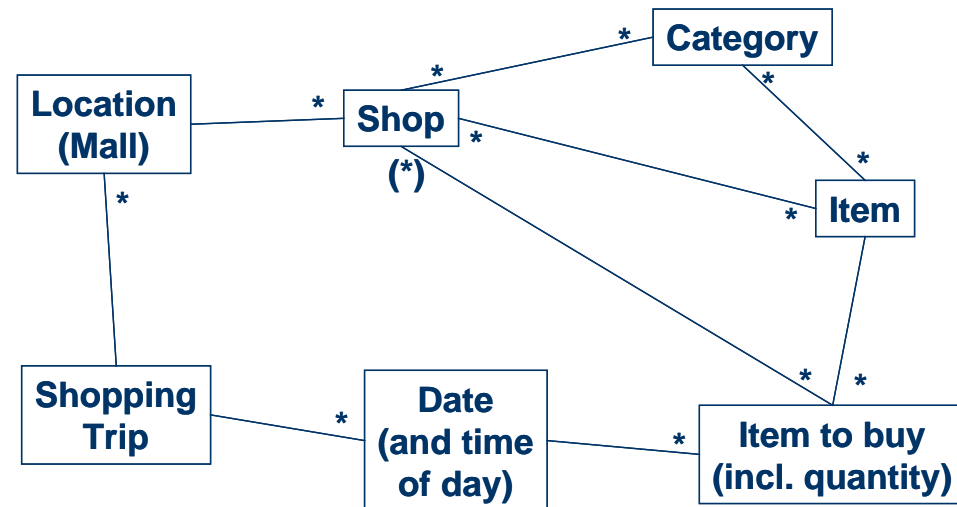
16:25 Adaptive solutions
16:45 Adaptive features in the exercise

17:15 Finish

Exploiting contextual information

- **Context changes are frequent for mobile user**
  - Not just location – and multi dimensional
    - Location, movement
    - Environment (near-by objects, visual conditions,
    - Personal characteristics
    - Tasks
    - Social role
    - Available information
- **Exploiting information about context and context changes is important**
  - May facilitate more user friendly applications and services
- **Enhancing existing solutions by exploiting contextual information vs.**
- **Context driven solutions**

Example:
Adaptive UIs in navigation systems

- Adjust layout based on screen characteristics
  - At startup
  - At runtime
  - Optimize information panel
- Estimated arrival time
  - Based on distance and speed limits
  - Based on distance, speed limits and actual speed past x minutes
  - Based on information about
    - Traffic
    - Road conditions
    - Weather
  - Based on historical data
- Adjust zoom level of map based on context
  - Based on speed
  - Based on events along the route
  - Based on type of road
- Tunnel simulation
  - Based on speed when entering
  - Based on speed when entering and speed limits
 - Use speed information from the car

Example:
Adaptive UIs in navigation systems

- When are instructions given?
    - Based on distance or time?
    - Based on speed limit / road type
- Information about speed limits
    - Show speed limits
    - Warn when breaking speed limits
        - Visually
        - Using audio
        - Absolutely vs. relative
        - Taking type of road and speed limits into account
- Information about speed cameras
    - Based on distance
    - Based on distance and speed limit
    - Only cameras on the current road/route
        - Only in current direction
    - Only when breaking the speed limit
        - Take acceleration into account
    - Slow down the car
- Switch between day and night mode
    - Manually
    - Based on position, date and time of day
    - Based on actual light conditions

Other important issues
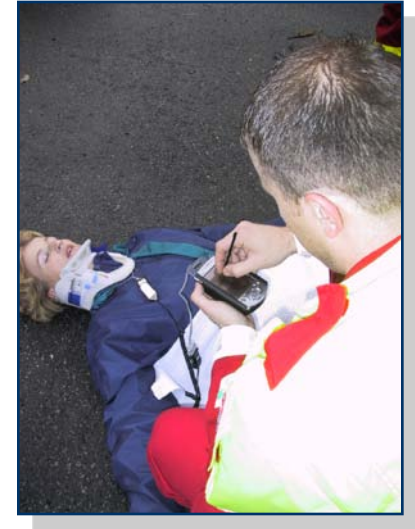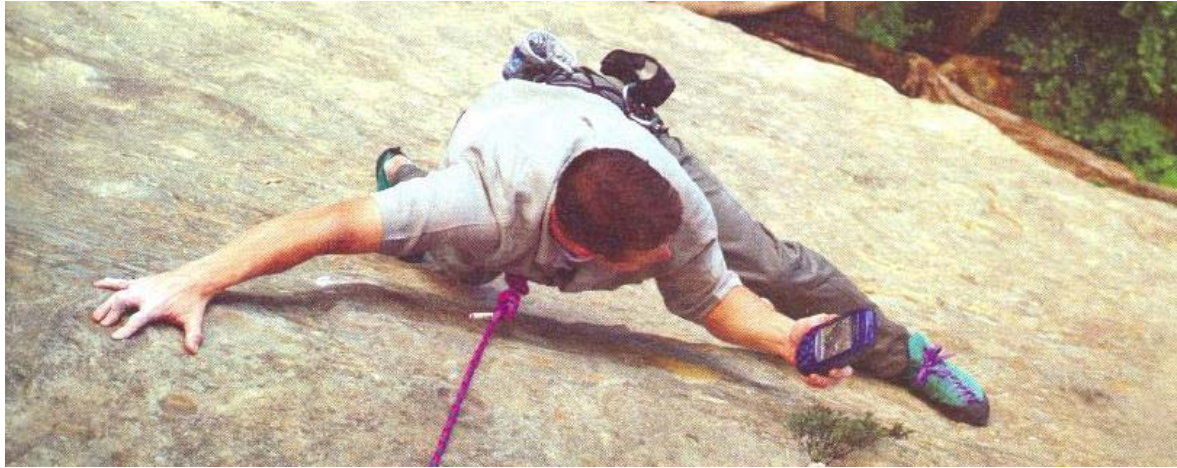
- Mobile users often focus on tasks outside the mobile device
  - Restricted attention to the visual part of an application
  - Hands free / one hand use
  - Safety
- Battery life, capacity, etc.

Agenda

13:15 Introduction, user interfaces on mobile equipment, important choices
13:30 Overview of the patterns collection

13:45 Introduction to exercise

14:00 Utilizing screen space - presentation
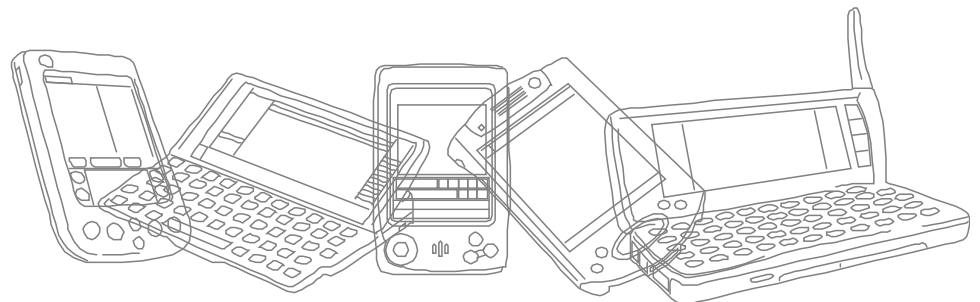14:20 Screen space challenges in the exercise – including break

15:20 Interaction mechanisms - presentation
15:40 Interaction challenges in the exercise
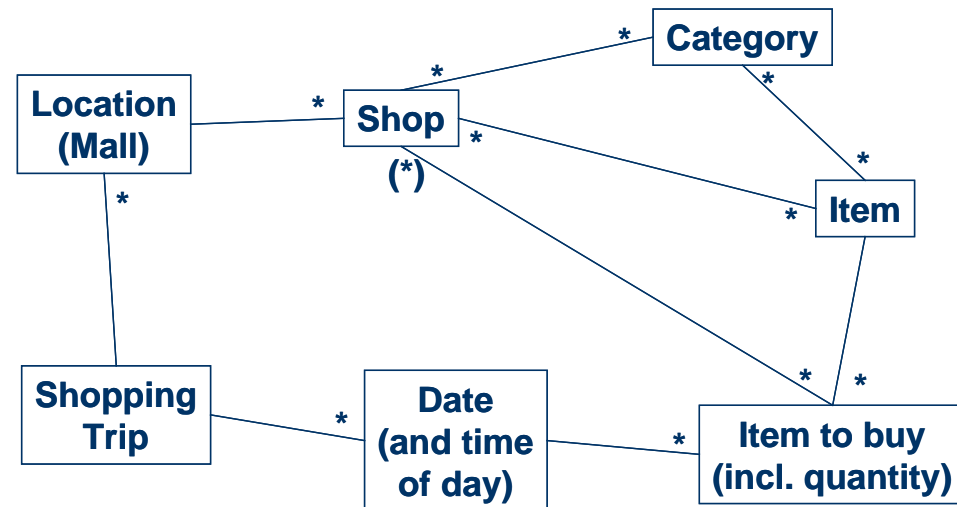
16:25 Adaptive solutions
16:45 Adaptive features in the exercise

17:15 Finish

Exercise - Shopping list

■ Can your solution be enhanced with adaptive behaviour?
  ■ Which sensors?
  ■ When and how should the UI adapt?
■ Revisit multimodal interaction
  ■ Add if you don't have any
  ■ Improve/enhance if you have

```
                                              *  ┌──────────┐
                                       *         │ Category │
                          *        ┌──────┐      └──────────┘
┌──────────┐     *        │ Shop │ *              *
│ Location │─────────────│      │──────────────          *
│  (Mall)  │              │ (*)  │ *                ┌──────┐
└──────────┘              └──────┘          *       │ Item │
      *                                             └──────┘
      │
      │
┌──────────┐          ┌──────────┐        *    * ┌──────────────┐
│ Shopping │          │   Date   │  *             │  Item to buy │
│   Trip   │─────────│ (and time │─────────────  │(incl. quantity)│
└──────────┘       *  │  of day) │      *         └──────────────┘
                      └──────────┘
```

Contact details

- Erik G. Nilsson
- SINTEF ICT, Oslo
- egn@sintef.no
- +47 22 06 78 85 / +47 930 89 477
- Patterns collection at:
  - www.flaminco.net

YGGDRASIL | 2009
DATAFORENINGENS KONFERANSE FOR BRUKERGRENSESNITT OG BRUKERDOKUMENTASJON