Smart Instant Messenger in Pervasive Computing Environments

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Agenda

- Introduction
  - Vision, Background, Motivation
- SIM@HKU
  - Design, Implementation, Demo
- Related work
- Conclusion and Outlook
Introduction
The Future Landscape

- Everything becomes *smart* and *connected*
  - The pen, the toy, the wall, the sitting room and “you”
  - They “talk” and cooperate to make your life better

*In A Perfect World...*
The Vision

Pervasive Communication
- Anytime, anywhere
- “Anything”
- In a buddy-like way
  - Appropriate
    - Knowing when, where, how
  - Familiar
    - “gd nite & cu tmr”
    - “分特” (faint)

Need for a new communication paradigm

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Eyes on Instant Messaging

The pervading IM

“42% of internet users report using instant messaging”

“53 million adults in U.S. trade instant messages and 24% of them swap IMs more frequently than email”

--- “Pew Internet and American Life” Survey 04

ICQ, MSN Messenger, Yahoo!, AIM, ...

Booming wireless runners
IM Peculiars

- Person-person communication through near real-time message exchange

- Presence-awareness
  - Indicates a user’s *responsive status*
  - Availability or willingness

- Sense of “Buddy”
  - Stay social and connected
  - One-click distance
  - Free talk in dialect
Pushing IM into PCE

- **Suitability**
  - Everything as your buddy
  - Awareness is key
  - An appealing application to boost technology adoption and revolution
Current Limitations – (1)

- **Presence vocabulary is limited**
  - E.g. Online/busy/away
  - Lack in meaning
  - May not be appropriate

- **Presence is displayed same to all**
  - Determined by the “Presentity” alone
  - Could not reflect the real situation and diverse relationships

- **Presence is manually set**
  - Troublesome, error-prone
  - Formidable for mobile users
Current Limitations – (2)

- **Person-to-Person Communication Only**
  - Excluding the smart things
- **Grouping is set and fixed**
  - Relationship in reality – dynamic, serendipitous, multi-fold
  - If too many buddies squeeze into the list, locating a buddy is not that easy
SIM in Action

- Context-aware presence management
- Resource buddy services
- Dynamic grouping
1. Context-aware Presence Management

- Context as presence
  - Location, activity, with whom you’re…
  - Extended, richer vocabulary

- Adaptive presence distribution
  - Different buddies see different status
    - E.g., available to the people here; yet “busy” to the outliers;
  - Based on current situation and the relationships

- Automatic update
  - Let the system infer the user’s presence
2. Resource Buddy Services

- Explicitly include resources
  - Device, Software, Widget...
  - Anything that is of certain usage
- Resources appear on the buddy list
  - Just like your buddy
  - When you need, when you’re near, what you’re fond of/interested in
- User-centric configuration
  - Buddy understands your dialect
  - E.g., A and B see different GUIs for the same printer, or maybe speak different commands
3. Dynamic Grouping

Location-based Grouping ("buddy discovery")
- Group the buddies according to the same location
- Effectively help you “bump into” a nearby buddy and initiate a serendipitous interaction
- Keep you aware of the surrounding resources, and of what are readily for usage

Activity-based Grouping ("task centric")
- Facilitate the collaborative work by grouping the activity partners, electronic resources and desired devices into a single group
SIM - Tiered Overview

- Extend the IM framework and implant context-aware behaviors
- Separate context provision from context consumption
System Deployment

- SIM as the unified communication interface
- Everything’s behind an SIM client
- Distributed Servers Architecture
Components & Interactions

- Extend Jabber framework and protocols
- Resource manager
- Context module
- Roster module

- CASM handles the chore of retrieving, processing, interpreting and reasoning over context information
- Ontology-based context modeling approach
- Support context query/reply and context event subscription
Campus Ontology Model

- Speaker
- MediaPlayer
- Computer
- ...

- Person
  - Lecturer
  - Student
  - Tutor
  - ...

- Device
  - hasDevice
  - hasDeviceLocation
  - isDeviceOf

- Activity
  - hasActivity
  - hasActivityLocation
  - isActivityOf
  - isActivityLocationOf

- Location
  - hasLocation
  - isLocationOf

- Time
  - hasTimeInterval

- Owl: Context Entity
  - relationship: isSubClassOf

- Speaker
- MediaPlayer
- Computer
- ...

- CurrentActivity
- ScheduleActivity
- ...

- ComputerLab
- MeetingRoom
- LectureRoom
- ...

- CurrentTime
- TimeInterval
Protocol Extension

- All communication is done through XML-formatted message exchange
- *Jabber* protocols are extended to deal with the presence, context, resource and grouping features
  - *Jabber:presence; Jabber:iq;*
Performance & Screenshots
Performance Evaluation

Memory Usage and Response Time of the Framework vs No. of instance

- Memory Usage (MB)
- Response Time (sec)

- 2 add operations
- 1 remove operation
- 1 class query
- 1 instance query
Screenshots (1)

Dynamic grouping on PDA
Screenshots (2)

(a) Menu for printer buddy

(b) Discover a PDF printer
Demo
Related Work
Related Work

- Origins: Media space, awareness systems
  - Mainly focus on human collaboration
- Context-aware Delivery
  - CybreMinder
    - Associates contextual information with to-do items and delivers them upon predefined condition
- Broaden the communication spectrum
  - ConChat
    - Allows exchanging or query of context
  - AwareNex
    - Displays activity and location information
  - PLIM
    - Combines presence, location into IM framework
Related Work

_similarity
• The focus is shifting from mere interaction to awareness

difference
• We emphasize on “everything as buddy”
• Adaptive presence distribution and dynamic grouping are not sufficiently explored
Conclusion
Outlook
Conclusion

- Extrapolate IM usage for Pervasive Communication
  - Buddy-like interaction & awareness
- Introduce context-aware behaviors into daily application
- Separate context provision from context consumption
- Design for extensibility
- Prototype for real life usage
Future Directions

- More interesting usage scenarios on small wireless devices
  - Meaningful presence, UI design
- Activity-centered and user-centered configuration
- Optimization of CASM performance
- Matured migration support
- Privacy issues
Questions?