Ubiquitous computing and context aware service delivery

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Outline

1. **Successful service provisioning requires efficient business models**
   - ✓ *Competitiveness with Semi-Walled garden business model*
   - ✓ *Open platform to get the mass market*
2. **New service scenarios and underlying technologies**
   - ✓ *Ubiquitous computing*
   - ✓ *Context awareness*
   - ✓ *Personalization*
3. **Semantic enhancement for advanced service provisioning**
   - ✓ *Needs for semantic and proactive services*
   - ✓ *Scenario with semantic services*
   - ✓ *Service request management*
4. **Conclusions**

Outline 1

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Business model deployment up to i-mode

	Operators Advantage	Movement to Open platform
Before *i-mode*	**phone number (SIM)**	**Number portability**

Open to the internet

Birth of *i-mode*	**portal site provider**	**Portal site selection**

Mobile NW Operators need to develop and provide both of

- ***Competitiveness with Semi-Walled garden business model***
- ***Open platform to get the mass market***

Business model deployment beyond i-mode

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Predicted Transition

	Operators Advantage	Movement to Open platform
Advanced i-mode	personalization & personal information database	Personal information portability (non real-time)

Ubiquitous and intelligence

Beyond i-mode	**context, personalization & ubiquitous real-time information processing on the open platform**

Operators applying cutting edge technologies to enhance their competitiveness on the open platform both for users and contents providers.

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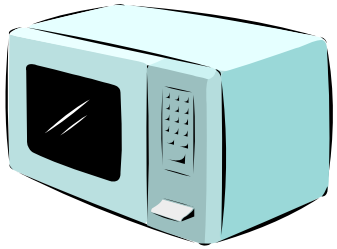
New service scenarios and underlying technologies

e.g. Usage scenario (1)

What is in the refrigerator now?

microwave oven



What kind of food does she like?

Does she go shopping right now?

Context awareness

What kind of technologies are needed?

Showing suggested menu and shopping list automatically to her

Technology requirements

- Ubiquitous computing
  Information gathering (what's in the refrigerator) and distribution using ad hoc networks combined with cellular networks

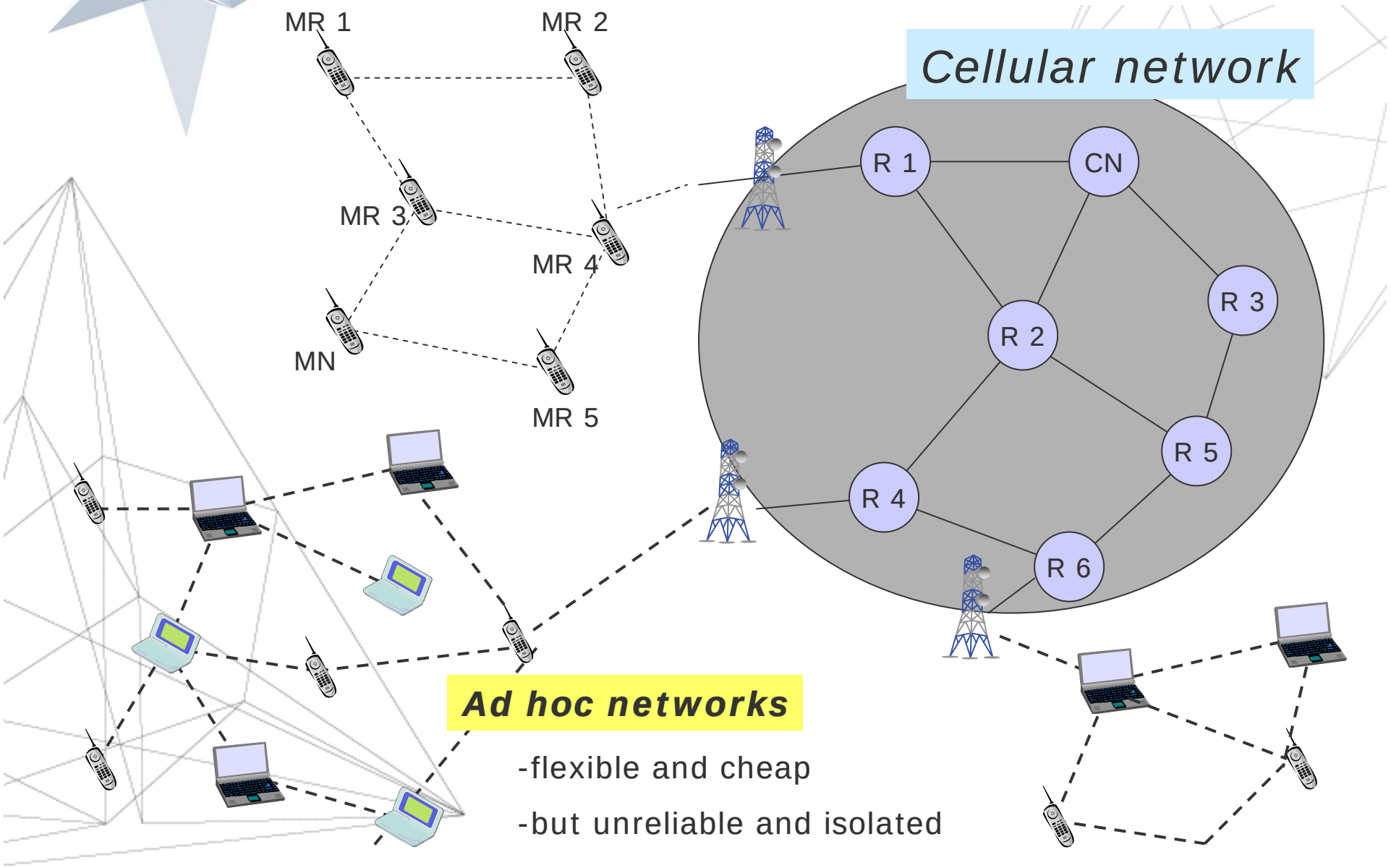
- Context awareness
  adding knowledge about anticipated & meaningful purpose (getting a complete dinner course) and create suitable conclusions (shopping list)

- Personalization
  (make dinner tasty)

Ubiquitous computing

- **Extension of *communication abilities* to *everyday objects***
  - ✓vehicles, household appliances, ...
- **Integration of the new world of *smart devices* to the *Internet***
  - ✓personal area networks, home networks, sensor networks ...
- **Users need adequate security levels**
  - ✓own, group, all, ...
- **Users should not need to be a system administrator**
  - ✓ plug and play

Ubiquitous computing needs for combination of ad hoc and cellular networks



New paradigm: Context aware service behavior

Context awareness is an attribute of a service, if the service is capable of accessing, interpreting and manipulating knowledge related to a set of environmental states to adapt its behavior

Examples of current context-aware service types

- ✓Location Based Services
- ✓Messenger application - friends list showing their state

Need for Context-awareness

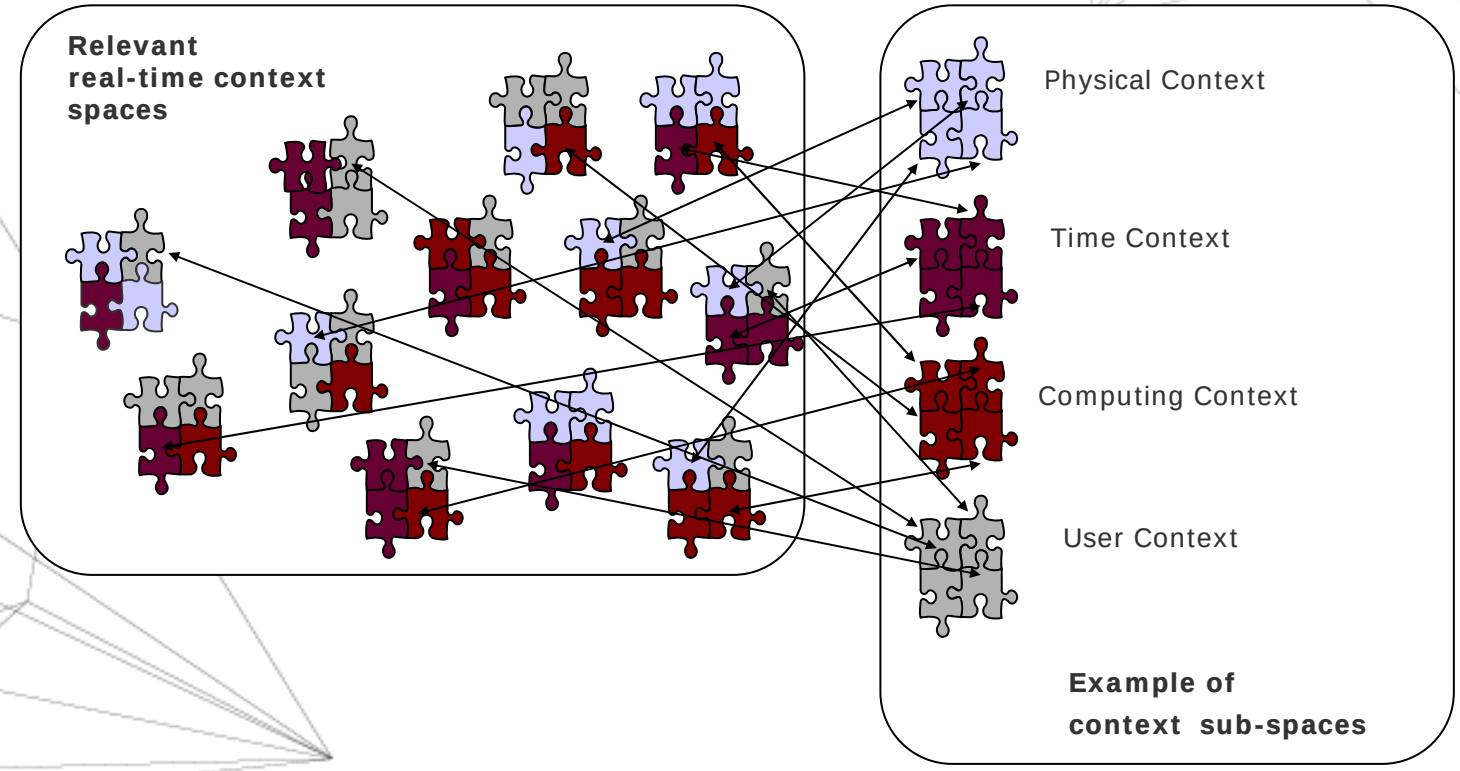
*Services adapt to the given context for *:*

- **Improving awareness**
  Discovering what context information help make intelligent communications decisions
- **Improving relevance**
  Deciding when adaptation is relevant to the current or near future situation
- **Minimizing disruption**
  Deciding when to and when not to adapt based on past knowledge
- **Reducing overload**
  Deciding how to filter information that don't apply to a given context
- **Selecting interaction**
  Effecting the environment with new context in the form of interactions

* List includes material by Bill Schilit, Intel Research

Context-space

- Ever changing environment favors adaptive service provisioning
  - ✓ exchange of context information
- **Context awareness principles are**
  - ✓ protocol-based, loosely coupled, and proactive



Context-aware service is emergent service

Emergent computation / Indirect programming

- Dynamic system behavior
  > The actual computation is emergent. It is hard to exactly predict the where, when, why and how of the resulting computation.

- Adaptively
  > The actual computation adapts its goals and actions.

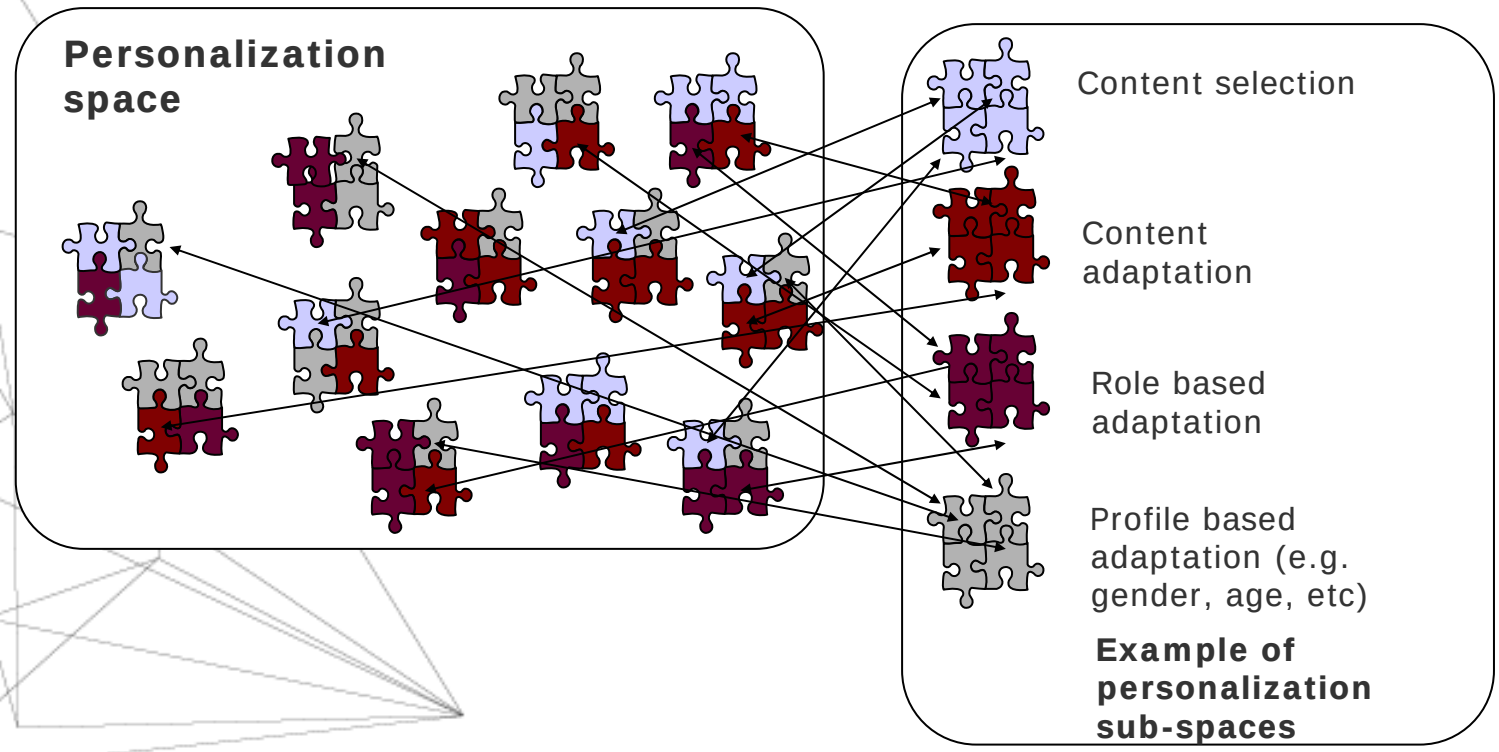
- Autonomy and interaction
  > The actual computation will find its way on the basis of it own view of the current state.

Need for Personalization

- Increasing diversity of services
  > Services B3G, converged networks/services, …
- Plethora of devices
  >Wireline phone, wireless phone, wireless hand-held, internet-connected desktop, laptop with WiFi, pager, …
- Different roles we have
  > Employee: approvals, project teams, travel, …
  > Personal: family, friends, clubs, travel, …
- Context that changes “on the go”
  > Office environment, airplane, week-end trip, daytime, night, …
- Multiple IDs to sign-on with different service
  > Download e-mail, read news, order books, …

Personalization-space

- Similar to the context-space but based on the personal perspective
- Content adaptation according to
  - user's preference
  - the role the user is acting in



Outline 3

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Need for semantic rich services

- Sound user model/description
- Sound service model/description
- Basis for matchmaking between service profiles and user preferences
- Benefit from knowledge engineering & artificial intelligence
  - Well known properties of formal logic
  - Ontologies allow for reasoning

Need for proactive services

- Discover applicable preferences
- Proactively advertise services
- Support users in completing tasks

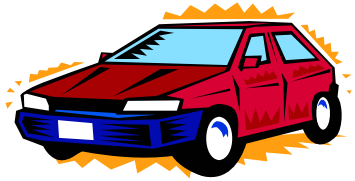
•Map user tasks to services (sub-goals)

•Support cooperative behavior to avoid
  ✓information flooding (under-specified request)
  ✓no-result effect (over-specified request)

•Learn / anticipate usage patterns

•Single time preferences vs. long-term profiles

Usage Scenario (2)



rent car at airport

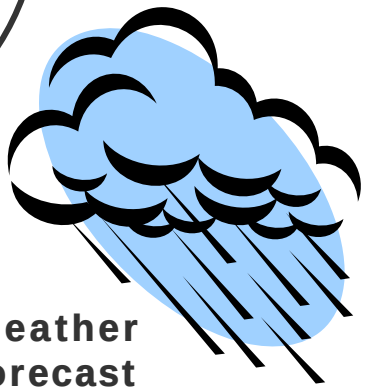
book flight

city guide

Michael on a business trip

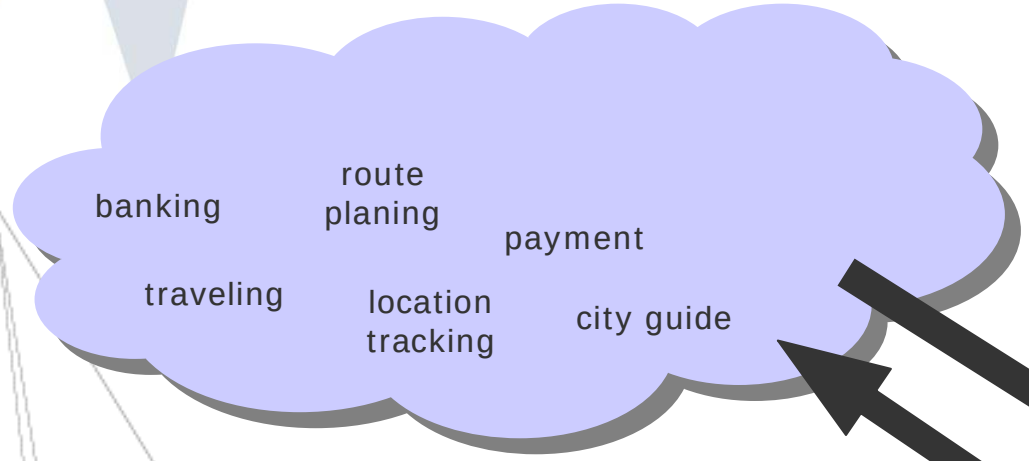
routing

find currency exchange

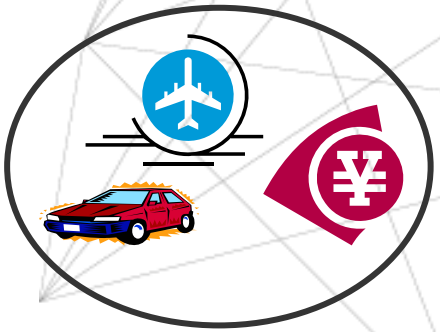


weather forecast

What's for mobile services?



achieve goal



choose service

? ? ?

Michael

It's not about using services,
it's about supporting your goals.

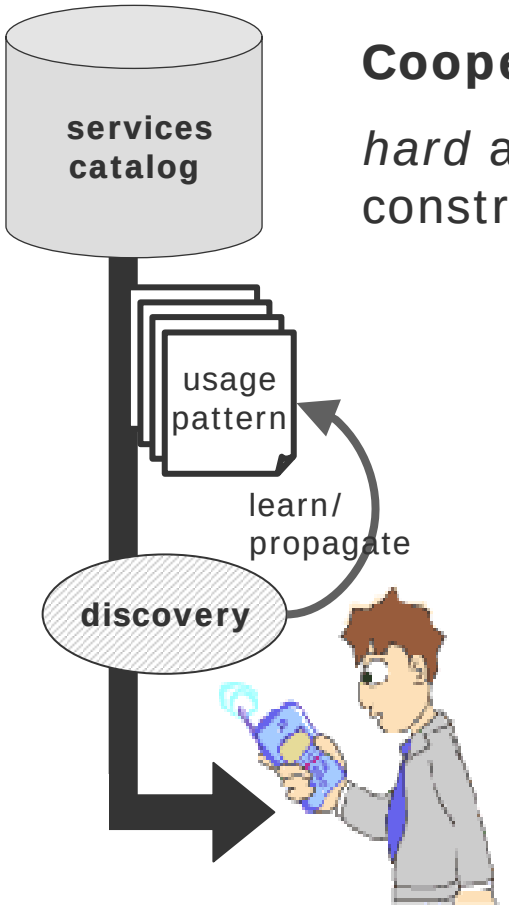
Proactive (pattern based) services

Problems with preferences:

> Users often are not able to specify their wishes *precisely*

> Worse, users mostly don‘t know their exact wishes at query time

> Users don‘t want to go through complex acquisition phases



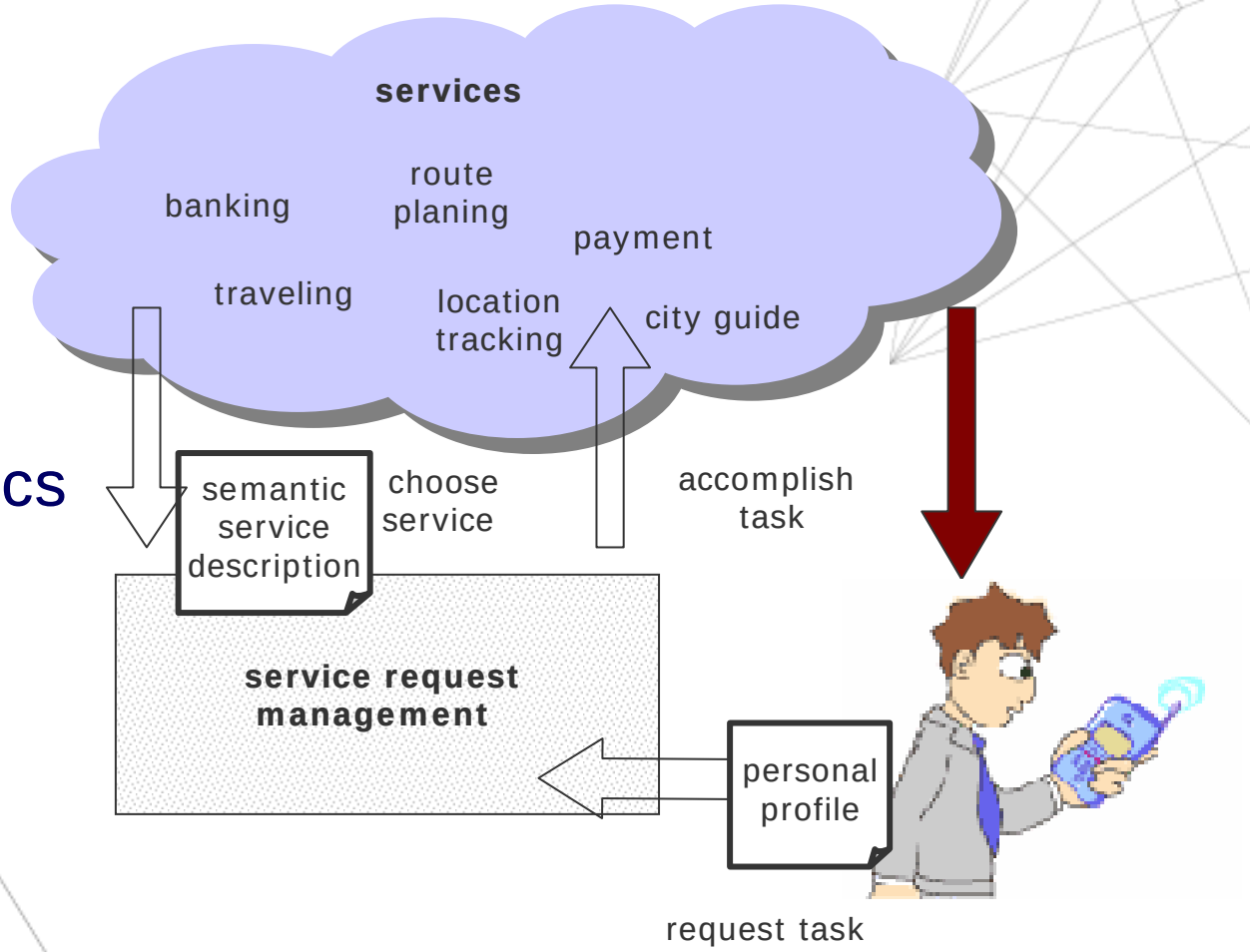
Service selection

Cooperative systems

hard and *soft* constraints

Semantic rich service behavior

Add semantics



Adapt Accomplish

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   - ✓ *Semantic service descriptions*
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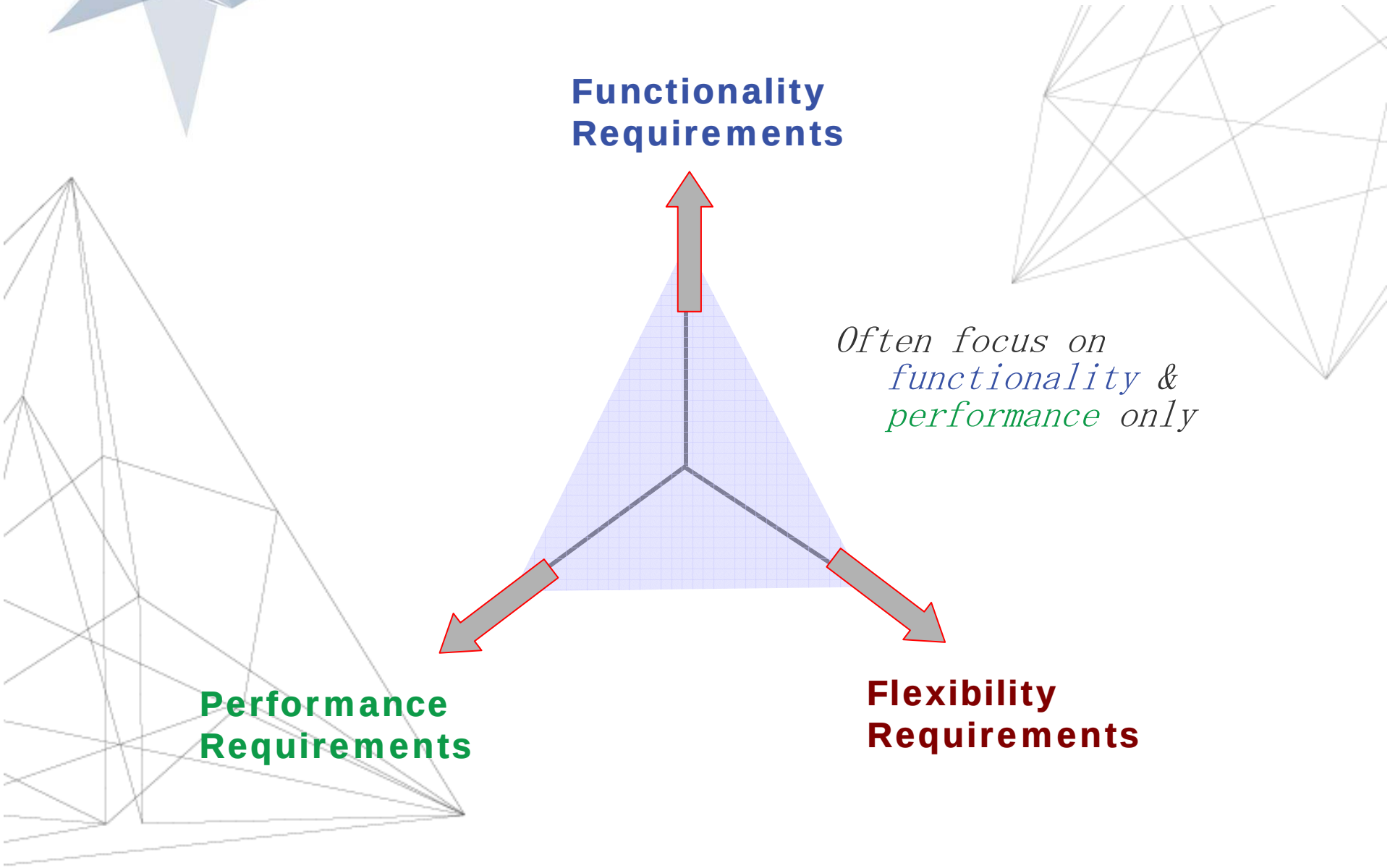
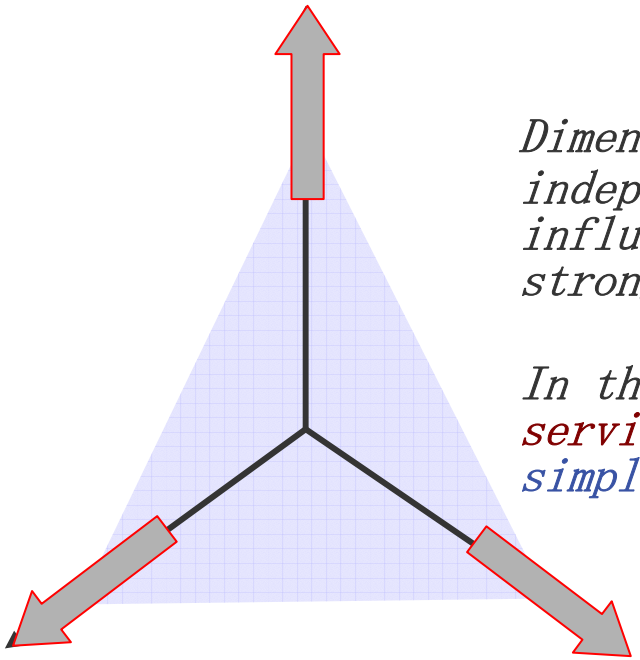
4. **Conclusions**

Conclusion: Add one more dimension to mobile systems ⇨ Flexibility



Often focus on functionality & performance only

Conclusion: Add more dimensions to mobile service provisioning



Dimensions are not independent and influence each other strongly

In the past: focus on service core and simple personalization

Danke schön

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