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# Toward the Mobile Grid: Service Provisioning in a Mobile Dynamic Virtual Organization

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# Key Issues & Outline

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- Move from fixed & research-oriented grid systems to mobile grids with a commercial focus.
  - Potential functional extensions needed?
  - Consequences on business models?
- Outline
  - Nature of a mobile grid
    - Related concepts
    - Organizational view
  - Business scenario
    - Travel insurance
    - Economic potential

# Nature of a Mobile Grid: Related Concepts (1)

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- Grid Systems
  - Grid computing (HPC, traditional)
  - Service grids (virtualization, current)
  - **Mobile grid (knowledge grid, next-generation)**
- Service-oriented Architecture (SOA)
  - Interoperability of heterogeneous nodes by means of standardized interfaces
- Peer-to-peer Systems (P2P)
  - Resource sharing among peers in the most decentralized form

# Nature of a Mobile Grid: Related Concepts (2)

## Technical Comparison

| Category     |                | CPU (1) | Decentralization as Design Goal (2) | End-to-end Connectivity (3) | Interoperability (4) | Location Transparency (5) | Robustness (6) | Standards (7) | Storage (8) |
|--------------|----------------|---------|-------------------------------------|-----------------------------|----------------------|---------------------------|----------------|---------------|-------------|
| Grid Systems | Grid Computing | Green   | Grey                                | Grey                        | Green                | Green                     | Grey           | Green         | Green       |
|              | Service Grid   | Green   | Grey                                | Grey                        | Green                | Green                     | Grey           | Green         | Green       |
|              | Mobile Grid    | Grey    | Grey                                | Grey                        | Green                | Grey                      | Orange         | Green         | Green       |
| SOA          |                | Grey    | Grey                                | Green                       | Green                | Green                     | Grey           | Green         | Grey        |
| P2P Systems  |                | Green   | Green                               | Green                       | Orange               | Orange                    | Green          | Orange        | Green       |

| Metric | Explanation   |
|--------|---|
| 1      | Computational power exploitable by offered services       |
| 2      | Fully decentralized system architecture envisaged         |
| 3      | Direct peer communicate, irrespective of nodes in between |
| 4      | Nodes of heterogeneous nature                             |
| 5      | Location information not bound to services                |
| 6      | Prone to failure and system attacks                       |
| 7      | Rely on open or widely accepted standards and protocols   |
| 8      | Storage capacity exploitable by offered services          |

Legend:

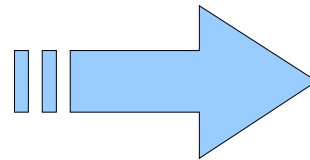
- Green: relevant and existent
- Grey: not relevant
- Orange: relevant, however, not existent in current designs or implementations

# Nature of a Mobile Grid: Organizational View

- Transition from VO to Mobile Dynamic Virtual Organization (MDVO)
  - Due to mobile grid's **functional extensions**
    - Support various forms of mobility
    - Dynamics, mainly imposed by mobility

## VO:

- Resource coordination
  - IT-supported
- Across administrative domains
- Economic Environment
  - Grid middleware for A4C



## MDVO:

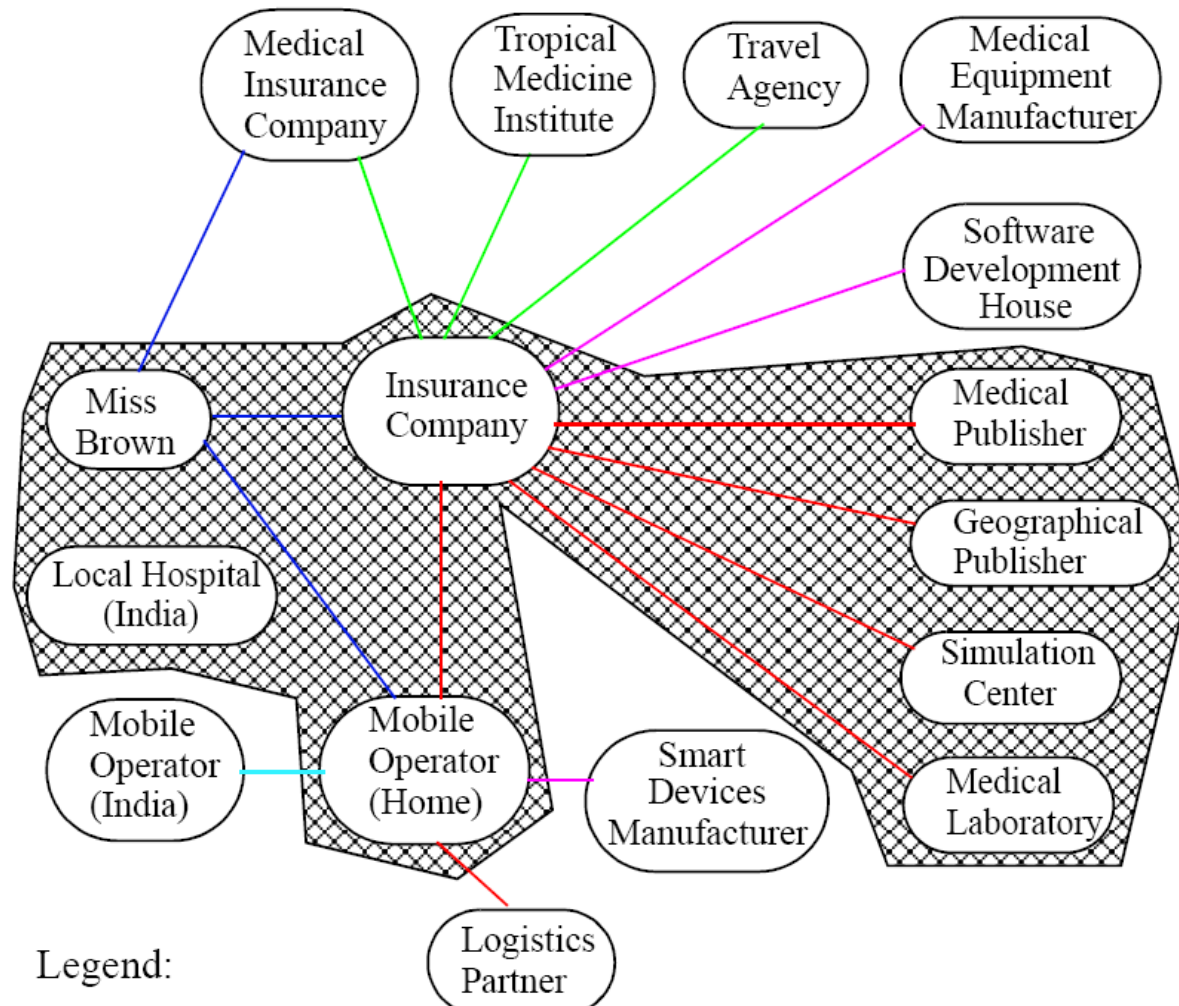
- Services remain available
  - Temporary hand-off
- Adaptive workflows
  - According to context information
- Dynamic organizational composition

# Business Scenario: Travel Insurance

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- E-health & tourism domains → match requirements
  - Field of application
    - Mobile or nomadic users
    - Knowledge-intensive tasks
  - Business model
    - Legally independent companies → MDVO
    - VO managing entity as service aggregator
- Motivation for travelers & insurance company
  - To know whether consultation of medical facilities is required
  - Early diagnosis

# Business Scenario: Organizational Alignment



Legend:

- Player
- ▣ MDVO (Mobile Dynamic Virtual Organization)
- Contractual Relationship
- Subscription
- Roaming Agreement
- Production Order
- Reselling Contract
- Service Level Agreement

# Economic Potential: Scenario-specific Issues

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- Insurance company
  - Understandable product
  - Differentiation
- Travelers
  - Individual needs reflected (customization)
  - Medical advice in a home-like manner
- Mobile Network Operators
  - Network access
  - Further services (customer management, billing)
- Content Providers
  - Expose content in pieces only (keep control)



# Conclusions

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- Integration of context (user & device)
  - Adaptive workflows
- Accounting (on network, grid, and content level)
  - Allow for subtle charging schemes
  - QoS-bundles
- Distributed value chain
  - Focus on core competencies (specialization)
  - Potential for economies of scale (offer similar service in different VOs)

# Thank you

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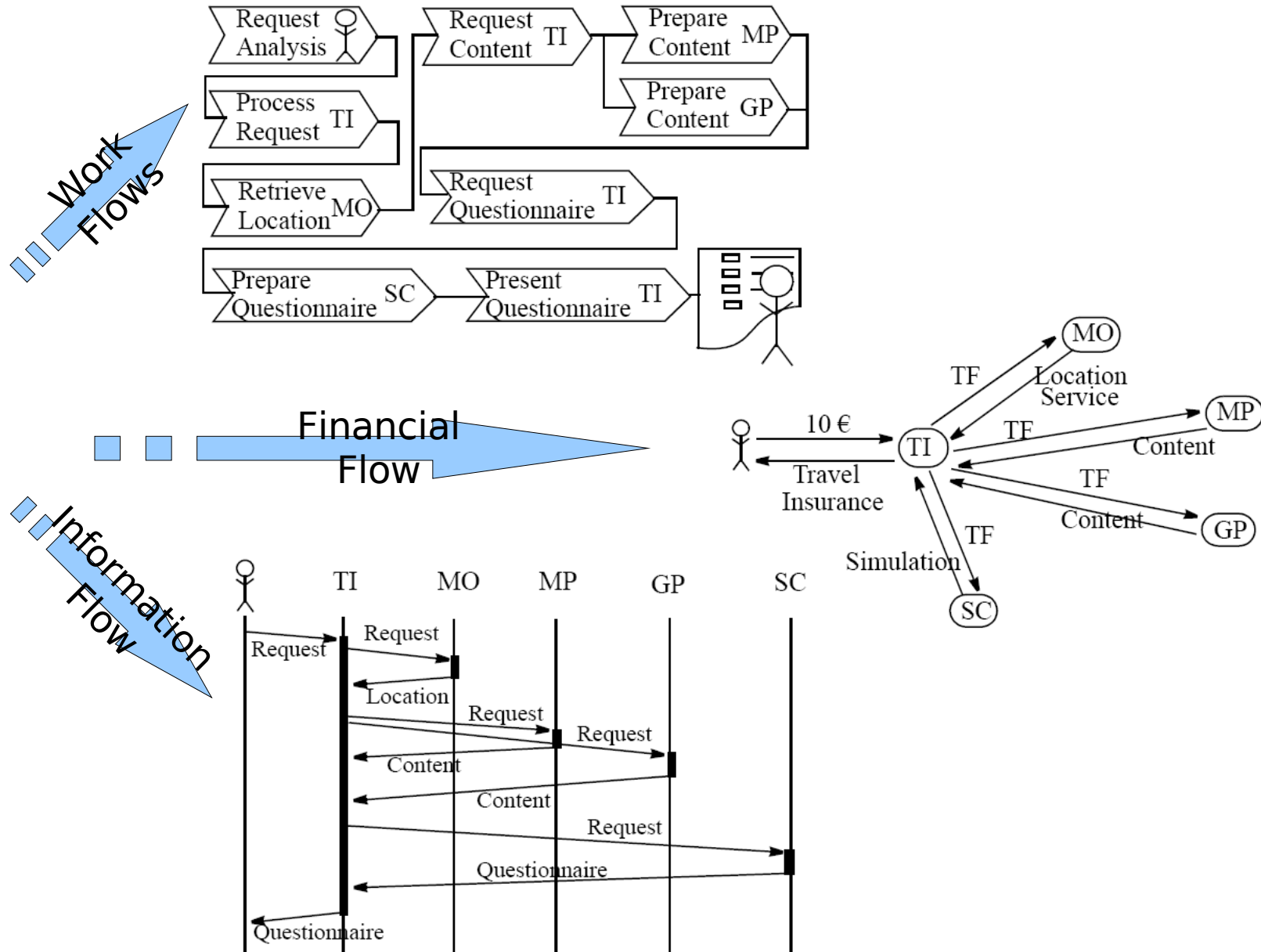
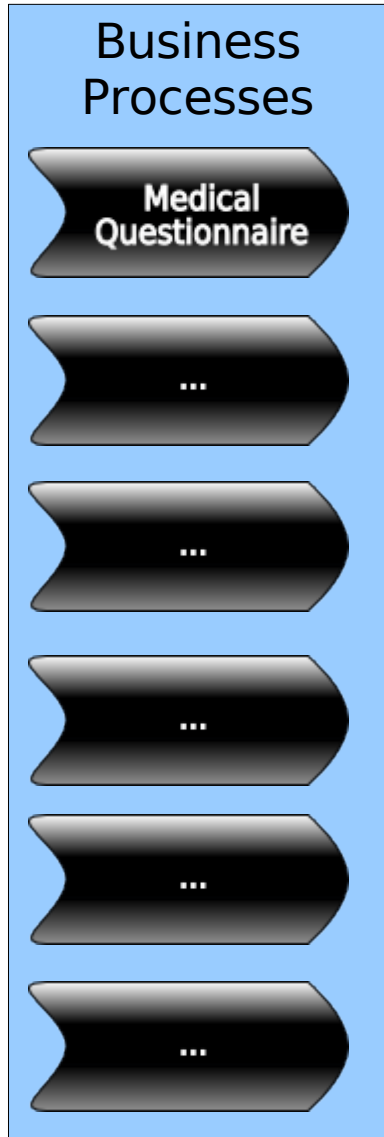
for your attention!



# Backup



# Business Scenario: Business Flows Analysis



# Grid vs. P2P vs. SOA

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- Related concepts compared by means of 8 technical and 9 business metrics
  - Both categories may show overlappings

## Technical Metrics:

- CPU
- Decentralization as Design Goal
- End-to-end Connectivity
- Interoperability
- Location Transparency
- Robustness
- Standards
- Storage

## Business Metrics:

- Ad-hoc Formation
- Commercial Usage
- Efficiency
- Inter-domain Service Provision
- Quality-of-Service (QoS)
- Resource Coordination
- Resource Sharing
- Scalability
- Service Aggregation

# Technical Metrics Explained

| <b>Metric</b>                   | <b>Explanation</b>   |
|---------------------------------|--|
| CPU                             | Computational power exploitable by offered services          |
| Decentralization as Design Goal | Typically fully decentralized system architecture envisaged  |
| End-to-end Connectivity         | Peers communicate directly, irrespective of nodes in between |
| Interoperability                | Nodes of heterogeneous nature                                |
| Location Transparency           | Location information not bound to services                   |
| Robustness                      | Prone to failure and system attacks                          |
| Standards                       | Rely on open or widely accepted standards and protocols      |

# Business Metrics Explained

| <b>Metric</b>                  | <b>Explanation</b>   |
|--------------------------------|--|
| Ad-hoc Formation               | Administrative or financial agreements taken before system becomes operational           |
| Commercial Usage               | Typically system used in commercial environment, implementing respective business models |
| Efficiency                     | Mechanisms for optimized usage of available resources                                    |
| Inter-domain Service Provision | Support of Virtual Organizations (VO)  |
| Quality-of-Service (QoS)       | Support of QoS-related parameters  |
| Resource Coordination          | Involve multiple resources in a structured way in a business process                     |
| Resource Sharing               | Conjoint access to resources, such as computation or storage                             |
| Scalability                    | Correct behavior under high system load  |
| Service Aggregation            | Combine basic services into composite advanced services                                  |

# Business Comparison

| Category     |                              | <i>Ad-hoc Formation</i> | <i>Commercial Usage</i> | <i>Efficiency</i> | <i>Inter-domain Service Provision</i> | <i>Quality-of-Service</i> | <i>Resource Coordination</i> | <i>Resource Sharing</i> | <i>Scalability</i> | <i>Service Aggregation</i> |
|--------------|------------------------------|-------------------------|-------------------------|-------------------|---------------------------------------|---------------------------|------------------------------|-------------------------|--------------------|----------------------------|
| Grid Systems | Grid Computing               | Green                   | Grey                    | Orange            | Grey                                  | Green                     | Grey                         | Green                   | Grey               | Grey                       |
|              | Service Grid                 | Orange                  | Green                   | Orange            | Green                                 | Green                     | Green                        | Grey                    | Grey               | Green                      |
|              | Mobile Grid (Knowledge Grid) | Orange                  | Green                   | Green             | Green                                 | Green                     | Green                        | Grey                    | Green              | Green                      |
| SOA          |                              | Grey                    | Green                   | Grey              | Grey                                  | Orange                    | Orange                       | Grey                    | Grey               | Orange                     |
| P2P Systems  |                              | Green                   | Orange                  | Green             | Orange                                | Grey                      | Grey                         | Green                   | Green              | Grey                       |

## Legend:

- green marks an attribute that is relevant and exists in the system in question
- grey is considered as not being relevant for a system
- orange denotes an aspect being relevant, however, not existent in current designs or implementations