Taxonomy for P2P Group Management Solutions

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Based on a literature review of more than 50 publications about P2P group management solutions,

- Taxonomy includes 6 examples representing the versatility of proposed solutions
  - Solution 1: "HIERAS: A DHT Based Hierarchical P2P Routing Algorithm"
  - Solution 2: "Trust-Based Community Formation in Peer-to-Peer File Sharing Networks"
  - Solution 3: "Service-Driven Group Management for Mobile P2P Services"
  - Solution 4: "A Utility-Aware Middleware Architecture for Decentralized Group Communication Applications"
  - Solution 5: "PP-COSE: A P2P Community Search Scheme"
  - Solution 6: "An Interest Group Model for Content Location in Peer-to-Peer Systems"
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• Four High-Level Properties
  • Motivation: The reason why groups are formed.
  • Criteria: The criteria that are used for selecting nodes to a specific group.
  • Methods: The algorithms or other methods for observing and evaluating the criteria, leading to the selection of nodes to a specific group.
  • Realization: The kind of underlying P2P network that is used as a basis for the solution and enables the running of the specified methods.

• Various categories under these four properties
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• Categories of Motivation
  • Search Efficiency: The efficiency of routing in the P2P network or (a more specific case) the efficiency of resource searching.
  • Group Communication: The ability to communicate in a suitable group (of human users).
  • Service Provisioning: Publishing and discovery of services on top of a P2P system.
  • Knowledge Sharing and Collaboration: The ability to share important information and collaborate in the context of specific tasks, often in a professional setting.
  • Trust, Security and Privacy Management: Enhance the trust, security, and/or privacy in P2P operations.
Categories of Criteria

- **Common Interests**: The members (humans) of a community share some common interests, related to e.g. content.
- **Node Capability**: The terminal devices' capabilities such as CPU power or memory.
- **Level of Trust**: How strong is the trust between the users (or nodes).
- **Social and Organizational Memberships**: Membership in a social group or organization.
- **Locality**:
  - **Physical**: How near the nodes are to each other, in terms of network latency or other physical network-related metric.
  - **Logical**: How near the nodes are to each other, in terms of hop-count or other logical network-related metric.
  - **Geographical**: How near the nodes are to each other, in terms of geographical distance.
Categories of Realization

- **Single Overlay**: The group or groups are created within a single overlay; the entire system contains only one overlay network.
  - **Structured (DHT)**: The organization and operation of the overlay is based on mathematical rules, usually on Distributed Hash Tables (DHT).
  - **Unstructured**: The organization and operation of the overlay is based on some "less exact" rules.
    - Pure: The system is completely flat (example: Gnutella 0.4), and each node has equal responsibilities.
    - Hierarchical: There is some structuring, such as edge-peer vs. super-peer distinction (example: JXTA).

- **Multi-overlay**: The group or groups are created using multiple overlays; the entire system contains multiple overlay networks that can be either structured, unstructured, or both. Multi-overlay-based solutions can be further classified to:
  - **Vertical**: A vertical system is usually described as a tree, where every layer or leaf is an independent DHT overlay network
  - **Horizontal**: All the leaf overlays are connected to a single common DHT overlay that is responsible for optimizing the routing in the whole network
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• Using the Taxonomy for the Classification, example

• Solution 1 has these properties
  • Motivation: Search Efficiency
  • Criteria: Locality
  • Methods: Analysis of Node and Network Performance
  • Realization: Multi-overlay, DHT

• Etc.!
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• Next steps
  • Feedback for the scope and extent
    • is it overblown, should it be simplified?
      • for example, less example solutions?
      • less categories?
    • are the naming conventions clear enough?
  • Discussion on the draft on the mailing list
    • need of this type of taxonomy as Informational RFC?
    • need to update solution/taxonomy space as other solutions emerge?
    • need for some feasibility/performance evaluation?
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• Thank you!

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