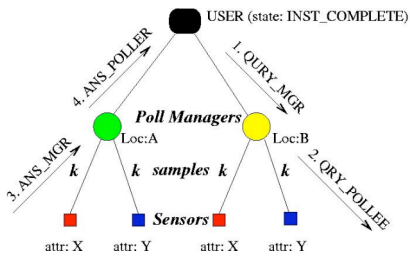


Demo: Distributed Task Execution in Mobile Ad Hoc Networks using Attributed Task Graphs

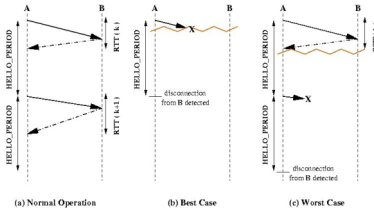
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Demo #1 : TG Instantiation



All messages shown are encapsulated as TASK_DATA packets processed by TaskApp layer only.



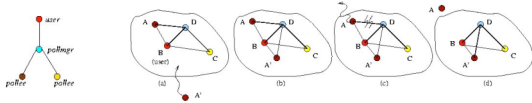
Detection of Disconnections

- Disconnections between instantiated nodes causes tasks to get disrupted
- These disconnections can be detected by periodic soft state HELLO messaging

Recovery from Disconnections (in taskd)

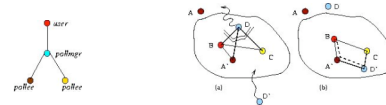
- Source of disconnections
 - Network partitions due to failure or mobility
 - Route failures for extremely long routes
- Next steps after detection:
 - Re-instantiation (replacement of a lost child)
 - TG-patching (salvaging the tree below the lost child)

Demo #2: TG Re-instantiation



- D, A, C are instantiated devices for {pollmgr, pollee, pollee} services respectively, B is the user (initiates poll/ coordinator).
- D (pollmgr / local coordinator) periodically monitors its child instances
- A (pollee) moves out of connectivity range of D (pollmgr) but A' is a device that also offers pollee service
- D (pollmgr) re-instantiates {pollee} with A'; informs B (user)
- B (user) updates its 2-hop logical neighborhood

Demo #3: TG-Patching



- D, A', C are currently instantiated devices for {pollmgr, pollee, pollee}
- B (user) then discovers D' which offers pollmgr service also (D' is 2 hops away from B)
- B (user) is periodically monitoring its child instance D (pollmgr) and detects a disconnection
- B (user) re-instantiates {pollmgr} with D' and passes on its 2-hop logical neighborhood information: [A', C] to D'
- D' (pollmgr) then TG-patches A' and C for {pollee}

Summary of Key Research Contributions

- A novel distributed framework for task based resource discovery and deployment
- Algorithms
 - Theoretical foundations: computational complexity issues in embedding TGs onto irregular networks (MANETs)
 - New algorithms and protocols for discovery/selection of devices in the network while obeying the TG structure/attributes
 - Approximation bounds for the heuristic algorithms
 - Techniques for efficient adaptation of distributed application / task to device mobility in the MANET
- Performance Evaluation
 - Metrics for analyzing performance of the above protocols
 - Performance evaluation by extensive simulation in ns-2
 - Development of a proof-of-concept prototype in a laboratory environment on off-the-shelf hardware
- Scalability Issues
 - Service composition using hierarchical task graphs
 - Focus: reuse of service instances that have been composed before by other users
- Future Work: Extending TG concepts to other application scenarios

Selected Publications

- P. Basu, W. Ke, and T.D.C. Little, "Dynamic Task Based Anycasting on Mobile ad hoc Networks," *ACM/Kluwer Journal on Mobile Networks and Applications (MONET)*, Vol. 8, No. 5, October 2003 (to appear)
- P. Basu, W. Ke, and T.D.C. Little, "Scalable Service Composition in Mobile Ad Hoc Networks using Hierarchical Task Graphs," *Proc. First Annual Mediterranean Ad Hoc Networking Workshop, (Med-Hoc-Net 2002, sponsored by IFIP)*, Sardegna, Italy, September 2002.
- P. Basu, W. Ke, and T.D.C. Little, "A Novel Approach for Execution of Distributed Tasks on Mobile Ad Hoc Networks," *Proc. IEEE WCNC 2002*, Orlando, FL, March 2002.
- W. Ke, P. Basu, and T.D.C. Little, "A Task Graph Based Application Framework for Mobile Ad Hoc Networks," *Proc. IEEE ICC 2002*, New York, NY, April-May 2002.
- P. Basu, W. Ke, and T.D.C. Little, "Metrics for Performance Evaluation of Distributed Application Execution in Ubiquitous Computing Environments," *Position paper at the ACM UbiComp 2001 Workshop on Evaluation Methodologies for Ubiquitous Computing*, Atlanta, GA, September 2001.