CS540 - Paper Review Report # 19

Hailu Belay Kahsay - 20155624

Title: A Delay-Tolerant Network Architecture for Challenged Internets

Author: Kevin Fall

In the paper it is stated that though it is not explicitly stated in TCP/IP protocol model plenty of key assumptions are made regarding the overall performance characteristics of the underlying links: an end-to-end path exists between a data source and its peer(s), the maximum RTT between any node pairs in the network is not excessive, and the end-to-end packet drop probability is small. The author claims that this model may not well serve class of challenged networks, such as Terrestrial Mobile Networks, Exotic Media Networks, Military Ad-Hoc Networks, and Sensor/Actuator Networks, as they may violate one or more of the assumptions.

To address these issues the author proposed Delay Tolerant Network (DTN) architecture that aims to provide interoperable communications between a wide range of networks which may have exceptionally poor and disparate performance characteristics. It is a general purpose message oriented reliable overlay architecture that provides the service semantics of asynchronous message delivery by forming Internetwork of challenged internets. In the DTN design the notion of message switching with in-network storage and retransmission, late binding of names, and routing tolerant of network partitioning are included to construct a system better suited to operations in challenged environments.

Issues related to DTN path and link characteristics, such as high latency, low data rate, and long queuing times; network architecture, such as Interoperability considerations and security; and end node resources, such as limited longevity, low duty cycle operation and limited resources are also discussed in the paper.

The paper also includes discussion on basic DTN network architecture and its components, way of identifying messages and objects(Name tuples), resource allocation technique(Priority-based resource allocation), path selection and scheduling (routing) mechanism, message routing node types: persistent (P) and non-persistent (NP), and DTN security approach.

Discussion points:

- Killer Application?
- Security Issues:
- Routing is done either by message replication or Knowledge based approaches (that acquires the network before sending the message):
    - Message replication----> flooding problem ----> Network Overhead
    - Knowledge based approaches requiring a global view of the network.
- Lack of common APIs to abstract DTN.

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Title: BUBBLE Rap: Social-Based Forwarding in Delay-Tolerant Networks

Author: Pan Hui, Jon Crowcroft, and Eiko Yoneki

The routing algorithms used in MANET and DTN needs to build and update their routing tables whenever mobility occurs before forwarding packets. In case of pocket switched networks (PSN), due to the fact that mobility is unpredictable and topology structure is highly dynamic, the authors argue that this forwarding technique is not an ultimate approach. As PSN is formed by people, the authors proposed using social metrics namely community and centrality, as intrinsic properties to guide data forwarding for such networks.

Initiated with the following four questions [1] How does the variation in node popularity help us to forward in a PSN? [2] Are communities of nodes detectable in PSN traces? [3] How well does social-based forwarding work, and how does it compare to other forwarding schemes in a real (emulated) environment? [4] Can we devise a fully decentralized way for such schemes to operate?, the authors have shown that it is possible to uncover important characteristic properties of social network from a diverse set of real world human contact traces.

Evaluating the impact of community and centrality on OSN data forwarding, the authors proposed BUBBLE algorithm, a hybrid algorithm that selects high centrality nodes and community members of destination as relays, designed for a delay-tolerant network environment, built out of human-carried devices. The result showed that the algorithm has significant improvement in forwarding efficiency and similar delivery ratio to, but much lower resource utilization than flooding, control flooding, PROPHET, and SimBet. Their demonstration have also shown that community and centrality social metrics can be effectively used in forwarding decisions.

Discussion points:

- Using more/composite social-based metrics to improving performance of Bubble Rap algorithm in delay tolerant networks? [Similarity, friendship]
- Buffer related issues?
- PSNs' buffer size is too low how to efficiently manage it?
    - Holding of messages in the buffer until a popular node is not encountered? Using TTL-based threshold
    - How to delete those messages which have already been delivered? Exchange of ACK IDs.
- The paper does not consider the impact of the battery usages of the mobile nodes, which could significantly affect the lifetime of mobile devices?
    - Energy Efficient Social-based Routing (EESR) protocol that lets a node to forward a message to the encountered node, iff the the current node has **lower** social metric than the encountered node (***social metric based message forwarding***).