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# CBR In Mobile Adhoc Networks by Using Self-Repairing Tree Topology

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**Key Words:** *Content Based Routing, Topology, MANET, COMAN*

**Abstract:** *Content Based Routing In Mobile Adhoc Networks By Using Self-Repairing Tree Topology is presented in this paper. COMAN a protocol for maintaining a tree shaped network in a MANET cenario.COMAN is designed to tolerate the dynamics of the underlying physical network characteristic of MANETs. It is also designed to minimize the number of brokers whose routing information are affected by topological changes, therefore improving the efficiency of the Content Based Routing as a whole. COMAN builds upon the tree maintenance algorithm found in the MAODV multicast protocol for MANETs. This algorithm is extended in a novel way for use in a CBR network, precisely to achieve aforementioned goals.*

## 1. Introduction:

Content-based routing of information have been proposed as a communication paradigm for advanced and mobile applications. Content Based Routing (CBR) fosters a form of implicit communication that breaks the coupling between senders and receivers. Senders no longer need to determine the address of communication parties. Similarly, receivers do not know; who is the sender of a message; unless this information is somehow encoded in the message itself. The sharp decoupling induced by this form of communication enables one to easily add, remove, or change components at runtime with little impact on the overall architecture. Content-Based Routing (CBR) holds the promise of addressing both these aspects with a single technology and a single routing infrastructure. The goal of supporting CBR explains the rationale behind the choice of a tree topology. Therefore the self-repairing tree enables the reuse of mainstream CBR protocols in the dynamic scenario characterizing MANETs, by leveraging off the consistent body of results related to the tree-based CBR. At the same time, providing a tree able to self-repair upon changes in the physical topology of a MANET is only our minimal (and obvious) target. Our ultimate goal is to design a protocol whose characteristics simplify the operations of the CBR layer operating on it.

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In real-life MANETs, nodes will possess different communication capabilities and processing characteristics. In Multicast Ad Hoc On-Demand Distance Vector (MAODV) protocol for multicast over MANETs. Indeed, MAODV organizes the members of each multicast group in a single tree without relying on any underlying multihop unicast solution. Moreover, the link repair process of MAODV is localized around one of the two end points of the broken link. This limits the impact of reconfiguration to a small portion of the system. The main aim of this paper is to achieve the repair strategies to tolerate the frequent topological reconfigurations in Mobile AdHoc Networks by Content Based Routing **(CBR)** using a protocol namely **COMAN**. This proposes the logic concerned with the maintenance of the tree topology and adapt, extend, and optimize it in a context from MAODV. It was not designed for CBR. The result and main contribution of this paper is COntent-based routing for Mobile Ad hoc Networks (COMAN), a protocol for maintaining a CBR broker tree in a MANET environment. Different from mainstream CBR approaches, which interconnects broker through a tree overlay, COMAN provides a tree topology directly at the network level. COMAN supports CBR over MANETs by efficiently maintaining a tree-shaped network with a short reconfiguration path.

## 2. Literature Review:

Several researchers done several research works on the similar lines such as Sanghyun Yoo et al [1] compare the approaches and propose a scalable publish/subscribe communication scheme in large MANETs by combining DF and CBR hierarchically. Gabriel Ioan Ivascu et al [2] presented a new approach based on a mobile routing backbone for supporting Quality of Service (QoS) in MANETs. Pedro García López et al [3] reported the routing protocols to the user space to simplify the development, testing, deployment and portability of middleware and applications. Prasan Kumar Sahoo., etal[4] proposed a novel route maintenance algorithms for the Bluetooth ad hoc networks, where nodes can enter or exit from the piconets time to time. Jennifer Yick et al [5] presented a comprehensive review of the recent literature and classify the problems into three different categories: (a) internal platform and underlying operating system, (b) communication protocol stack, and (c) network services, provisioning, and deployment. Sasu Tarkoma and Jaakko Kangasharju [6] examined the cost and safety of handoff protocols for subscribers and publishers in CBR networks. Gianpaolo Cugola and Elisabetta Di Nitto [7] reported the two requirements of SOAs for a global discovery agency, which assists requesters in finding their required services, and the need for new interaction paradigms, which overcome the limitations of the usual request/reply style. Y. Huang and H. Garcia-Molina [8] presented a Publish/Subscribe Tree Construction in Wireless Ad-Hoc Networks. E. Yoneki and J. Bacon [9] presented a novel approach for messaging systems with content-based subscription in mobile ad-hoc networks. K. Chen and K. Nahrstedt [10] presented multicast routing protocols in MANET to incur large overhead due to dynamic network topology. Y. Chen and K. Schwan [11] presented dynamically adapts event dissemination structures to changes in physical topology, in nodes physical locations, and in network node behaviors, with the goal of optimizing end-to-end delays in event delivery. Cordeiro, C et al [12] reported the recent advances in portable computing and wireless technologies of wireless mobile networking.

Content-based routing (CBR) in dynamic environments is a challenging issue. The research community has tackled this problem either by trying to adapt solutions designed for existing systems, which mostly use tree shaped overlay topologies, or by developing dedicated routing mechanisms. The protocol is described and evaluated to organize the nodes of a MANET in a self-repairing tree enabling the former approach, regardless of the specific CBR scheme in use. In this sense, close to work is the proposal in, which presents a way to implement a content-based publish-subscribe service on a MANET by constructing a hierarchical topology to distribute messages. However, the authors make fairly constraining assumptions, in that they assume knowledge about the placement of publishers (always at the root) and the distribution of messages with respect to subscriptions.

The evaluation is carried out, where a node moves only occasionally and then settles down for a period of the order of minutes. A different form of content-based publish-subscribe is proposed in, where the authors describe mechanisms to reconfigure an overlay network according to the changes in the physical topology and to the current brokers load. Unlike other solutions, each broker must be provided with a global view of the system. Moreover, this proposal does not handle partitions and strongly relies on an underlying unicast protocol. Finally, as the evaluation concerns a test bed with only three nodes. The authors propose an extension to the On-Demand Multicast Routing Protocol (ODMRP) to enable CBR on MANETs. The dissemination infrastructure is built using summaries of content-based subscriptions coded as Bloom filters. Again, the results are obtained only in a small-scale simulated scenario of 10 nodes and only with controlled reconfigurations, that is, insertion or removal of a single link. The aforementioned works try to achieve efficient CBR by relying on some form of tree. On the contrary, in highly mobile scenarios, the overhead to maintain a tree may become unreasonable. Recently, our group addressed this problem in two ways. The work in proposes a semi probabilistic approach to CBR where subscriptions are forwarded only up to a given number of hops from the subscriber. When there is no deterministic information, messages are forwarded to a randomly selected subset of the neighbors. Instead, in each node autonomously decides about forwarding messages, based on its estimated distance from the closest node interested in the content of the message. This value is computed by measuring the time since they were most recently able to communicate. In principle, the aforementioned approaches should perform more efficiently than the one described here in highly mobile scenarios. Conversely, the solution described in this work should be more effective in settings with lower mobility, for example, when node movement can be modeled according to a group mobility pattern. An extensive evaluation of the three approaches is in our immediate research agenda.

A different solution is described in, where a form of CBR is proposed to disseminate information coming from sensor like devices to mobile units within a scope defined by time and space constraints. The scenario and assumptions taken in this case are fairly restrictive. For instance, the authors assume information about the position, speed, and direction of mobile units and monitored phenomena. Furthermore, they deal with multihop communication by relying on a unicast routing protocol. It was considered a much more general scenario and more easily verified assumptionsbasically, the availability of local broadcast and unicast. Additional techniques to address the peculiarities of content-based mobile scenarios are discussed in and. The work in relies on replication to overcome the challenges stemming from node mobility. Proximity filters are proposed to define a spatial scope where messages are delivered to the mobile nodes interested in their content. These works do not propose any dedicated routing solution, rather focusing on architectural and design issues. Further investigation is needed toward a possible integration with the solution presented here.

## 3. Multicast Communication:

The work described here adapted the topology maintenance mechanisms of MAODV to a CBR scenario. However here this document report about other proposals in the field of MANET Multicast those are close to our requirements, that is, maintaining a flat (that is, no hierarchies or backbones) acyclic network in the presence of mobility.One way of achieving multicast communication in MANETs is to implement it on top of the MAC layer, therefore tackling mobility and link disruptions directly at the network layer. Alternatively, one can rely on some underlying multihop unicast mechanism providing point-to-point communication and let this deal with mobility and reconfigurations. Now, the second approach creates a layer of indirection hiding many aspects related to reconfiguration. Instead, to retain control of mobility, to tailor the broker tree reconfiguration to our needs. Inevitably, this implies removing any intermediate layer between the topology maintenance mechanism and the network itself. In the Ad Hoc Multicast Routing protocol utilizing Increasing ID-numbers (AMRIS), a bidirectional shared tree is built by exploiting a ranking order among group members. The link repair process is somehow similar to MAODV, with the downstream node trying to reconnect by Looking for a new parent node. The modification is illustrated in makes this process more general and able to find farther replacement links. The Core Assisted Mesh Protocol (CAMP) and ODMRP exploit mesh like topologies. With respect to the tree-shaped network provided by MAODV, they provide redundant paths at the expense of additional processing for maintaining multiple routes and discarding duplicates. Similar to MAODV, CAMP and Ad Hoc Multicast Routing (AMRoute) require at least one special node for reconnecting lost partitions. ODMRP and MAODV have been extensively compared in showing that the former provides better packet delivery at the expense of higher network traffic and, thus, reduced scalability. DCMP is another source initiated multicast protocol that exploits a mesh topology similar to ODMRP. However, in this case, the control overhead is improved by dividing sources into active and passive. Active sources are responsible for creating a shared mesh also on behalf of the passive ones associated to them.

## 4. System Design:

A user manual for the desired system is a good problem statement. The requestor should indicate which features are mandatory and which are optional, to avoid overly constraining design decisions. The requestor should avoid describing system internals, as this restricts implementation flexibility. Performance specifications and protocols for interaction with external systems are legitimate requirements. Software engineering standards, such as modular construction, design for testability and provision for future extensions. There may sometimes be a compelling reason to require a particular computer or language; there is rarely justification to specify the use of a particular algorithm. The analyst must separate the true requirements from design and implementation decisions disguised as requirements. A problem statement may have more or less detail. A requirement for a conventional product, such as a payroll program or a billing system, may have considerable detail. A requirement for a research effort in a new area may lack many details, but presumably the research has some objective, which should be clearly stated. Most problem statements are ambiguous, incomplete, or even inconsistent. Some requirements are just plain wrong. Some requirements, although precisely stated, have unpleasant consequences on the system behavior or impose unreasonable implementation costs. Some requirements seem reasonable at first but do not work out as well as the request or thought. The problem statement is just a starting point for understanding the problem, not an immutable document. This involves challenging the requirements and probing for missing information.

## 5. Modules:

Modules are classifieds into three categories such as (1) Neighbor Node Detection (2) Tree Maintenance for CBR (3) Partition Merging.

***Neighbor Node Detection:*** In mobile ad hoc networks all the nodes sending message to other nodes to find Neighbor nodes. Here using Multicast to other nodes to find Neighbor nodes. Multicast will broadcast their distance and coverage information to their Neighbors. The protocol exploits four kinds of messages:

***Route request (RREQ):*** This is broadcast by a node willing to join a specific multicast group, repair a branch of the tree, or merge two network partitions. It contains the identifier of the target group and the most recent sequence number known for it. When used to repair the tree, RREQ contains also the last measured hop distance from the leader to the sender.

***Route reply (RREP):*** This is unicast toward a node that previously broadcast an RREQ to inform it that its request can be satisfied. RREP contains the identifier of the target group, its most recent sequence number known at the responding node, the identifier of the leader, and the current distance between the RREP sender and the leader. This information, along with the number of hops traveled by the RREP, is used to infer the new distance of the requesting node from the leader.

***Multicast activation (MACT):*** This is unicast to explicitly activate a particular route toward the multicast tree. Furthermore, specific flags are used to implement operations such as identifying a new group leader after a failed repair, pruning a node from the tree, and updating the nodes' distance from the current leader. Node pruning is required when a forwarder node becomes a leaf. Instead, the nodes distance from the leader must be updated whenever the tree topology changes.

***Group Hello(GRPH):*** This is periodically broadcast by each group leader and rebroadcast across the whole network. Its main purpose is to disseminate the group sequence number and let each group member verify its distance (in hops) from the leader. It is also used to update the information at group members in case the group leader has changed, using a proper flag.

***Tree Maintenance for CBR:*** Some of the drawbacks in existing MAODV's tree topology maintenance. This document addresses the challenges of our target, by self repair the tree in CBR using COMAN protocol. This module is used to minimize the route changes after the path will fail or node will move due to the topology changes. This section describes how we build upon and extend MAODV's tree topology maintenance mechanisms to address the challenges of our target domain, that is, CBR on a MANET.

***Minimization of Route Changes:*** When a change in the broker tree occurs, the routing information used to perform CBR must be updated accordingly.

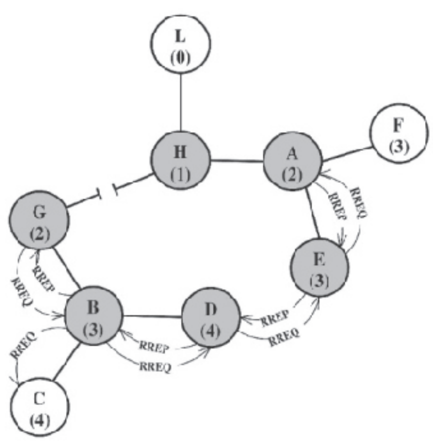


**Fig. 1: Highlighting the messages needed to repair the tree.**

To overcome this limitation, we store at each node an ancestor list containing the identifiers of all of its tree ancestors, starting from the group leader. For instance, with reference to Fig. 1, the ancestor list of node A is <L,H>. The dark gray nodes are those on the reconfiguration path.

***Request Propagation:*** In CBR scenarios, instead, it is typical to assume that all the nodes run a broker of the CBR network, which routes messages for the application components running on the same host. A single tree must be built and maintained to span all the nodes. It is observed that the issues arising from an uncontrolled propagation of RREQs come from the fact that these messages are allowed to propagate off the tree for more than a single hop. If rule forces each RREQ to jump off the tree at most once, it prevent loops and, at the same time, increase the chances that a disconnected node immediately reconnects.

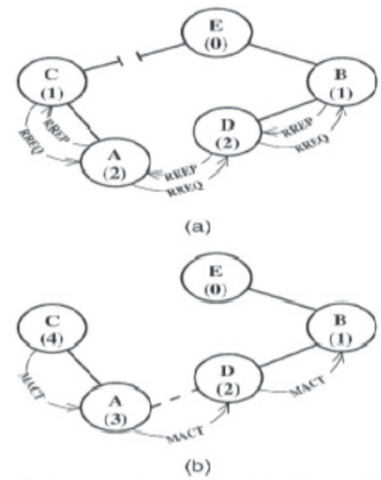


**Fig. 2: RREQ propagation using modified forwarding rule. (a) RREQs are now allowed to jump off the tree at most once. (b) After the replacement link is activated, the distances from the group leader are updated.**

## 6. Testing:

Testing is a process of technical investigation, performed on behalf of stakeholders, that is intended to reveal quality-related information about the product with respect to the context in which it is intended to operate. This includes, but is not limited to, the process of executing a program or application with the intent of finding errors. Quality is not an absolute. it is value to some person. Testing can never completely establish the correctness of arbitrary computer software. Testing furnishes a criticism or comparison that compares the state and behavior of the product against a specification.

***Black box testing:*** In Black box testing without knowledge of the internal workings of the item is tested Tests are usually functional.

***Compatibility testing:*** Compatibility testing used to ensure compatibility of an application or Web site with different browsers, OSs, and hardware platforms. Compatibility testing can be performed manually or can be driven by an automated functional or regression test suite.

***Functional testing:*** Functional testing performs validating an application or Web site conforms to its specifications and correctly performs all its required functions. This entails a series of tests which perform a feature by feature validation of behavior, using a wide range of normal and erroneous input data. This can involve testing of the product's user interface, APIs, database management, security, installation, networking, etc. All software components are installed successfully.

***Unit testing***

Functional and reliability testing is an Engineering environment producing tests for the behavior of components of a product to ensure their correct behavior prior to system integration. The behavior of components is tested and is shown in form of a table under test cases section. 'Positive test cases' section shows the particular cases in which software successfully provides correct result. 'Negative test cases' shows the particular cases in which software not provides result or false result.

## 7. Conclusions:

COMAN a protocol for maintaining a tree shaped network in a MANET cenario.COMAN is designed to tolerate the dynamics of the underlying physical network characteristic of MANETs. It is also designed to minimize the number of brokers whose routing information are affected by topological changes, therefore improving the efficiency of the Content Based Routing as a whole. COMAN builds upon the tree maintenance algorithm found in the MAODV multicast protocol for MANETs. This algorithm is extended in a novel way for use in a CBR network, precisely to achieve aforementioned goals.

## 8. Nomenclature:

AODV-Ad hoc On Demand Distance Vector
CBR-Content Based Routing
COMAN-Content Based Routing for Mobile Ad hoc Networks
MACT-Multicast Activation message
MANET-Mobile Ad hoc Network
MAODV-Multicast Ad hoc On demand Distance vector
ODMRP- on-demand multicast routing protocol
RREP-Route Reply
RREQ-Route Request

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