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# MANET Radio Management Model
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## Abstract

The MANET Working Group is developing management interfaces, i.e., Management Information Base (MIB) modules, for its control protocols, e.g., Neighborhood Discovery Protocol (NHDP), Simplified Multicast Forwarding (SMF), etc. The NETMOD Working group is developing a set of standard YANG modules for the basic configuration management of standard IP capable devices. Future IP capable radio networks will rely upon these and other modules for their management. The convergence of these activities requires the development of a conceptual radio management model to help promote a consistent set of modules for the configuration, monitoring and notification management of typical wireless radio devices. This document provides such a framework.

## Status of this Memo

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## 1 Introduction

Current wireless radio devices employed for military, emergency services or other networking domains are rather complex devices. These devices range from simple MAC level and below networking devices, which provide interfaces to IP routers, to extremely complex networking devices consisting of applications running on hosts which are logically connected to embedded routers with multiple (sometimes hierarchical) wireless interfaces. Currently, the proprietary management interfaces to these devices are monolithic, ill-logically organized and providing an inconsistent set of objects and services. This document intends to promote a standard radio management model to help in the development of standard models (i.e., YANG and MIB modules) for management of a broad set of radio devices.

### 1.1 Terminology

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in RFC 2119 [RFC2119].

## 2 Objective

Breaking down the structure of the radio into functional layers allows radio systems to define management modules that are logically compartmentalized, straightforward and practical in size. In this manner, we also allow for modules that are agile enough to let radios of varied levels of complexity to tailor precisely which modules are needed for their management based upon their capability set. Conforming to this model would also provide for configuration consistency across platforms. This in turn would simplify other aspects of configuration management including compatibility, training, isolation, troubleshooting, procurement, and technology evolution. Furthermore, we can avoid redundancy by leveraging existing modules that fulfill the functionality represented by the layer.

## 3 Radio Management Model

This section defines the radio management model.

We define three radio management models to represent the functional layers of a radio as it relates to the function performed and protocols used. The first of these models shows a standard top down layering of functionality with network interfaces communicating on a 1-to-1 basis. This would depict a radio functioning as a router with a single interface out of a single antenna. The other models

represent a 1-to-many and a many-to-1 router interface to antenna configurations as identified in following subsections.

### 3.1 Non-multiplexed Management Model

At the top level of the model is the application layer. Multiple running applications are supported with a standard being defined that can be extended to include parameters specific to the individual application. These applications map to the hosts on the next layer down. Again, multiple hosts running on a radio are supported in this model.

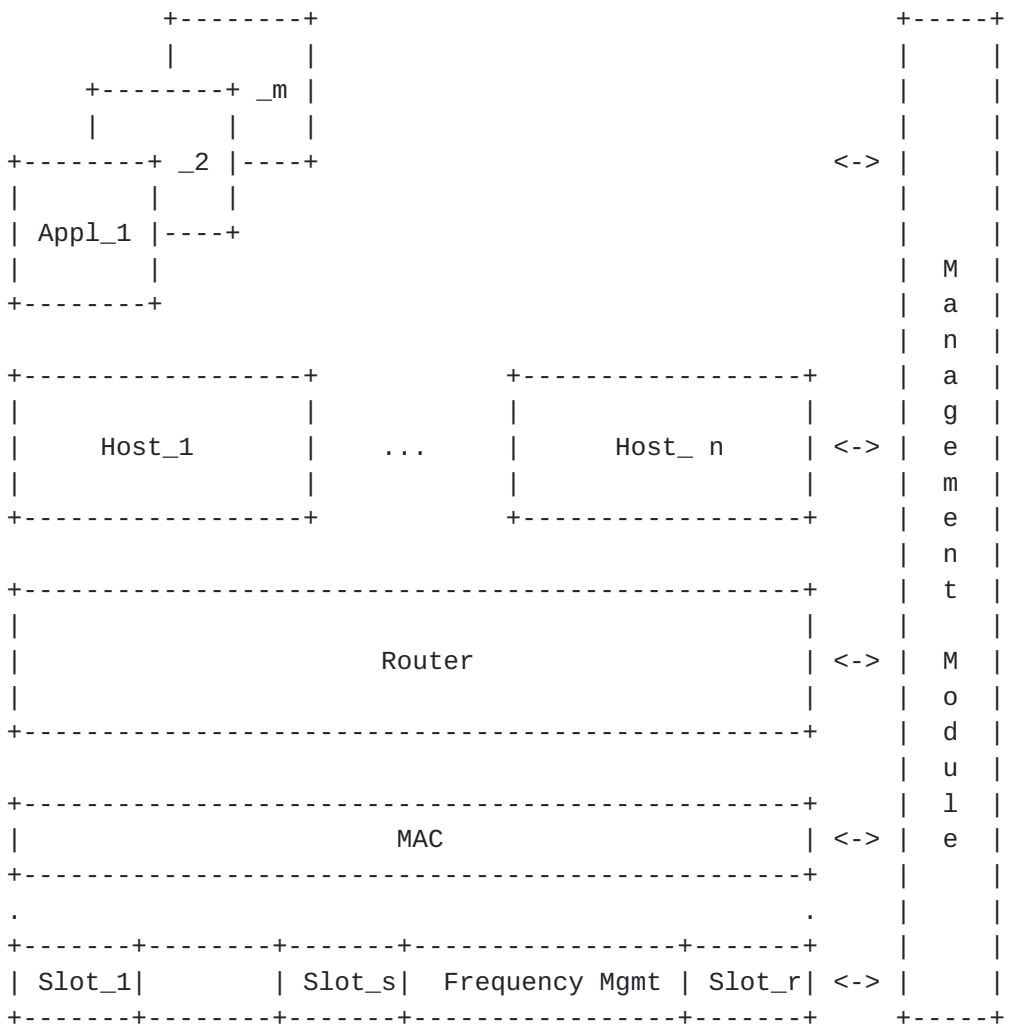


Figure 1. Non-multiplexed MAC Radio Model

The routing and MAC layers includes all parameters necessary for network routing and wireless medium access (e.g. address tables, MAC addresses). The Frequency Mgmt layer handles basic frequency band definitions (e.g. power level). In this model, no virtual interfaces are represented, i.e. the router interface maps to a single device (MAC and Physical antenna) interface, e.g. gr0.

Running alongside these layers and interacting with each is an associated management module. Management modules will exist within actual radio implementations and provide configuration, state, performance and notification management of all aspects of the radio implementation.

Several of the layers within the conceptual radio model presented here have already been codified into management modules through SMIv2 [RFC2578] or YANG [RFC6020]. For example, within SMI numerous modules

covering a significant number of functional areas have already been standardized. Some of these include (but are not limited to):

- Application - SYSAPPL-MIB [RFC2287]
- Host - HOST-RESOURCES-MIB [RFC2790]
- Standard MIB-II - [RFC1213] (which includes tcpTable (updated in [RFC4022]), udpTable (updated in [RFC4113]), ipForwarding (updated in [RFC4293]), ifTable, atTable, etc, providing management interfaces to broad networking functionality of all IP-capable devices.)
- Various control protocol MIBs, e.g. OSPF-MIB [RFC4750], NHDP-MIB [I-D.ietf-manet-nhdp-mib], SMF-MIB [I-D.ietf-manet-smf-mib], etc.

The netmod community has several drafts submitted which would establish YANG counterparts to these modules. These include Routing [I-D.ietf-netmod-routing-cfg], System Management [I-D.ietf-netmod-system-mgmt], and Interface Configuration [I-D.ietf-netmod-interfaces-cfg].

### 3.2 Downward Multiplexed Radio Management Model

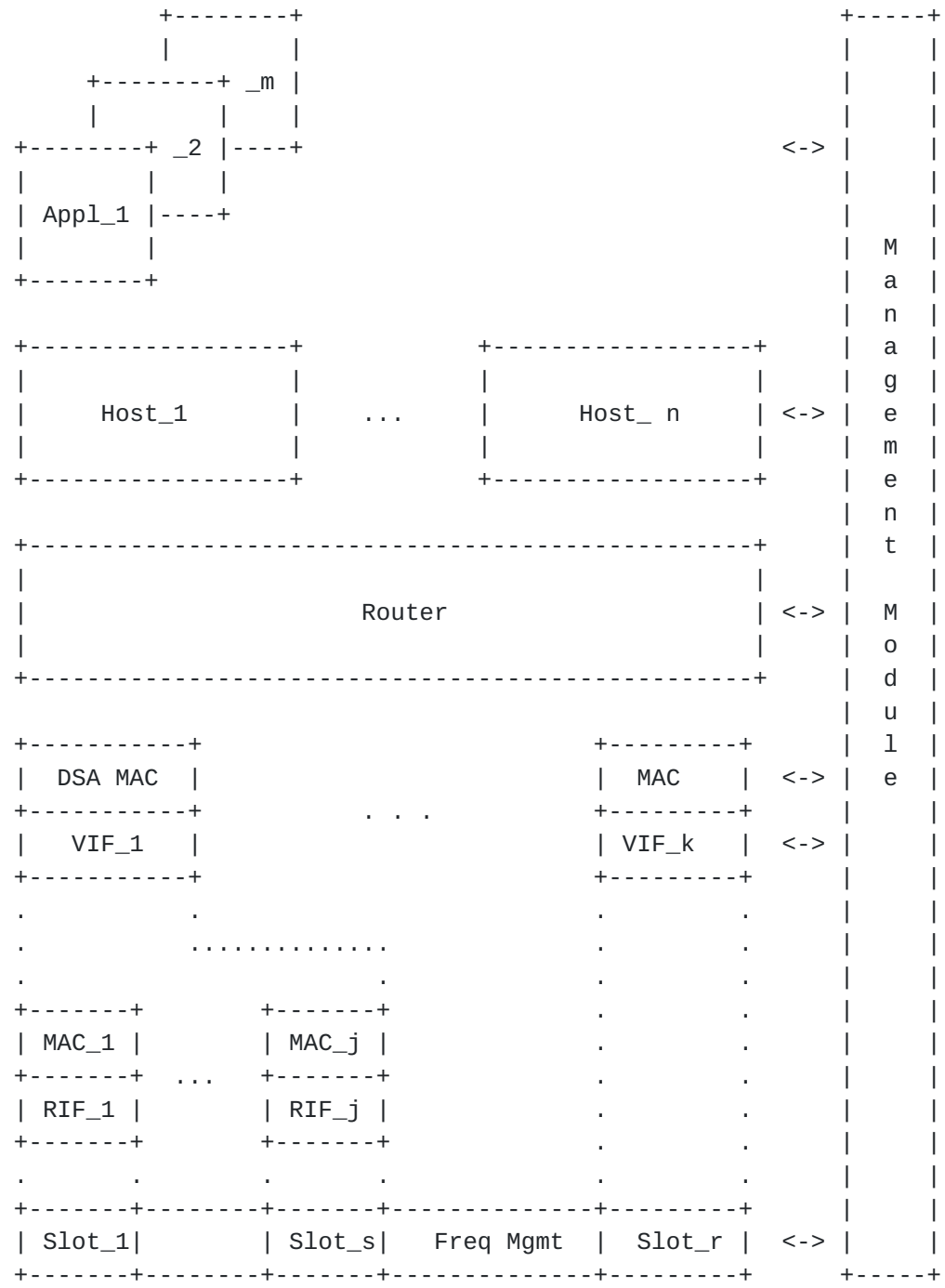


Figure 2. Downward multiplexed MAC (DSA)

In the "Downward Multiplexed Radio Management" model, the router sees one or multiple interfaces, e.g. dsa0, dsa1, etc. Each interface is a collection of real interfaces, one for each antenna system. This is representative of, for example, a Dynamic Spectrum Access

implementation. Here the router interface is managed by a high level MAC protocol (e.g. the DSA MAC) which manages data receipt and transmission over multiple real interfaces operating on different frequencies with separate instances of MACs (e.g. MAC 1 to MAC-j).

These types of downward multiplexed interfaces can be defined within the context of the ifInterfaceTable of the IF-MIB [RFC2863] and the draft interface YANG module. [I-D.ietf-netmod-interfaces-cfg]

The IF-MIB defines an interface to the router and how the interface to the router relates to the interfaces on the network. These relationships are expressed using a stack table with pointers to map to interfaces. The ifStackTable can also be used to represent the relationship of multiple interfaces to a single interface. Using this data structure, we can express the architectures of the downward and upward multiplexing radio models. The draft interface YANG module seeks to define the framework of a corresponding data structure for this mapping in YANG.

### 3.3 Upward Multiplexed Radio Management Model

In the "Upward Multiplexed Radio Management" model, the router sees one or more physical interfaces, e.g. eth0, eth1, etc. Multiplexed on the physical interfaces are a set of virtual interfaces, (for example, of type PPPoE, e.g. vir0.0, vir0.1, ...) This is representative of a radio to router interface on Ethernet where each radio/router pair discovered establish a PPPoE connection forming a virtual interface on the router.

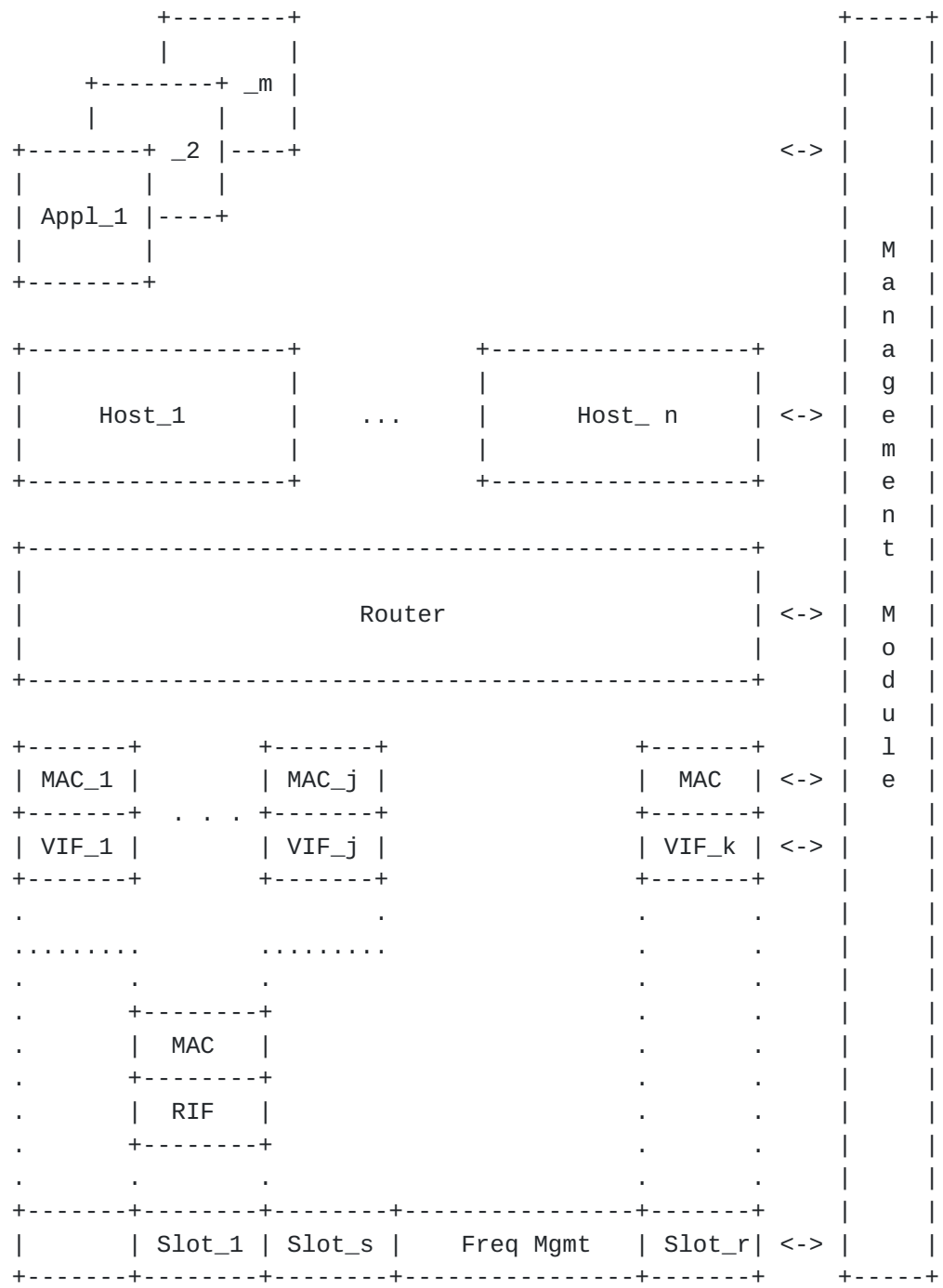


Figure 3. Upward Multiplexed MAC

## 4 Next Steps

There is a need for the development of standardized MAC layer modules for wireless networks along with their management modules. The modules for managing these protocols for the most part do not exist,

with 802.11 being the exception [IEEE802dot11-MIB]. The structure of our standard model would represent a device using this standard. Another effort would be the development of a standard frequency interface to manage the frequency across multiple MACs.

By writing this document, we are looking to develop commonality of a management model within the radio vendor community. This commonality will improve systems interoperability, improve management, and reduce the training and support cost incurred by the consumer communities for these IP networking devices.

## 5 Security Considerations

This document specifies a framework for standardizing the development of radio management models. It does not raise or consider any protocol-specific security issues.

## 6 IANA Considerations

This memo includes no request to IANA.

## 7 References

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