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Logical Interface (LIF) Implementation Guidelines  
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## Abstract

A Logical Interface is a software module internal to the host that is available in all popular operating systems. The use of this Logical Interface allows supporting different network-based mobility management solutions. In the NETEXT WG, work has been carried out to define ways in which a Logical Interface can help IP flow mobility (IFOM) for Proxy Mobile IPv6 [I-D.[draft-ietf-netext-logical-interface-support](#)]. The same Logical Interface construct can help other mobility management solutions like 3GPP GPRS Tunnelling Protocol (GTP), and it can add benefits to multi-access scenarios such as 3GPP Multi Access PDN Connectivity (MAPCON). This document provides guidelines for the implementation and configuration of a generic Logical Interface.

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LIF Implementation Guidelines

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## [1.](#) Introduction

A Logical Interface (LIF) is a construct internal to the operating system. It is an approach where the link-layer implementation hides the physical interfaces from the IP stack in the host. The IP stack can bind one or many IPv4 and/or IPv6 addresses onto this interface.

The basic LIF function is widely available in all popular operating systems. Many applications such as Mobile IP client [[RFC3775](#)], IPsec VPN client [[RFC4301](#)] and L2TP client [[RFC3931](#)] rely on this semantic for their protocol implementation.

This basic LIF functionality can be expanded for achieving more advanced mobility features. For instance, in the NETEXT WG work has been carried out to define requirements on this Logical Interface to support IP flow mobility (IFOM) for Proxy Mobile IPv6 [I-D.[draft-ietf-netext-logical-interface-support](#)]. Beyond Proxy Mobile IPv6, the use of a LIF can also help supporting IP flow mobility for 3GPP GPRS Tunneling Protocol (GTP), and similarly it can add benefits to other multi-access scenarios such as 3GPP Multi Access PDN Connectivity (MAPCON) [TD S2-103593].

This document describes the guidelines to implement and configure a generic LIF module to enable the aforementioned mobility and multi-access features.

## [2.](#) Conventions and 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 [[RFC2119](#)].

This document uses the terminology defined in [[RFC5213](#)], [[RFC3775](#)], and [[RFC3810](#)].

## [3.](#) Logical Interface (LIF)

### [3.1.](#) Description

The LIF is a software construct that presents itself to higher layers (i.e. IP) as a normal single interface. However, instead of providing access to a single physical or network interface (i.e. NIC), it can bond one or several network interfaces. As a result, an IP layer that binds to a single LIF will potentially encompass access to several physical interfaces. The actual specific data packet delivery to the

different network interfaces is fully controlled by the LIF and it is also hidden to the IP layer.

For some implementations, the LIF is known as the master, and the different sub-interfaces that are bonded below it are referred to as slaves. In most cases, the LIF will bond several physical network interfaces. Nevertheless, virtual interfaces (e.g. VPN) can also be treated as slaves and be bonded by the LIF.

Although the main purpose of the available LIF modules is to provide for link aggregation and redundancy, it has been shown that some of the LIF functionalities can be expanded to support more advanced features, like multi-access handovers and IP flow mobility.

#### 3.1.1. Usage in PMIPv6

Proxy Mobile IPv6 [[RFC5213](#)] is a network-based approach to solving the IP mobility problem. In a Proxy Mobile IPv6 (PMIPv6) domain, the Mobile Access Gateway (MAG) behaves as a proxy mobility agent in the network and performs the mobility management on behalf of the Mobile Node (MN) or IP host. The Local Mobility Anchor (LMA) is the home agent for the MN and the topological anchor point.

At present, there is work going on in the NETEXT working group to extend the basic PMIPv6 functionality to support inter-access handovers and IP flow mobility [I-D.[draft-bernardos-netext-pmipv6-flowmob-00](#)]. As part of this work, the LIF has been identified as a critical element in the MN required to support these IP flow mobility and inter-access handover features. A basic set of LIF functionalities has been identified in the group to support multi-homing, inter-technology handovers and IP flow mobility in a Proxy Mobile IPv6 network [I-D.[draft-ietf-netext-logical-interface-support](#)].

#### 3.1.2. Usage in GTP

Another network-based mobility approach proposed in 3GPP is based on the GPRS Tunnelling protocol (GTP) [TS 23.402]. Similarly to the PMIPv6 architecture, the PDN-GW behaves as a single anchor point and the Serving Gateway and ePDG perform the attachment functions on behalf of the MN.

Since GTP tunnels between the gateways and the anchor are transparent to the mobile, the LIF at the MN can perform the exact same actions on traffic flows regardless of the network-based mobility solution. This means that a LIF configured to support the PMIPv6 case can also support the GTP scenario without any modifications.

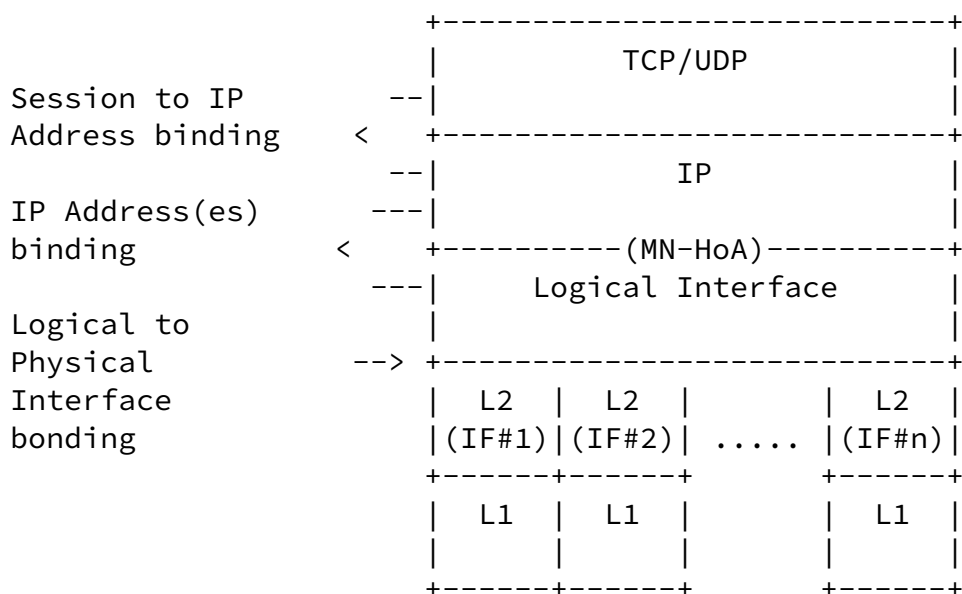


Figure 3: LIF for Proxy Mobile IPv6 / 3GPP GTP

### [3.1.3.](#) Usage in MAPCON

MAPCON is a 3GPP technology and refers to the capability of the Evolved Packet Core (EPC) network to configure and maintain two or more PDN connections for a given mobile device across heterogeneous wireless access networks. According to 3GPP, a one to one mapping exists between a PDN connection and an APN. That is, every time that a UE requests to activate a specific APN (either resolved to the same

P-GW or to different P-GWs) the network assigns a new IP address (v4, v6 or v4v6). This APN (or IP address) can be configured on a 3GPP network at time T0 and moved at time T1 to the WLAN network. It derives that all the sessions associated to this IP address (alias Home Network Prefix) are handed over from the 3GPP to the non 3GPP access network. If the UE has configured two different APNs on the 3GPP access network, after the handover procedure takes place it will continue to use one APN for each wireless channel.

In a 3GPP context and from an application perspective, the selection of an IP address corresponds to map a specific application to a given APN. In the IETF world the APN concept does not exist and IP address selection has been studied in [\[RFC3484\]](#) and [\[RFC5014\]](#). In particular [\[RFC5014\]](#) provides socket API extensions to influence the rules specified in [\[RFC3484\]](#) (e.g. prefer a public IPv4 address over a private one, prefer a HoA over a CoA). However, such extensions do not consider the particular requirements imposed by 3GPP.

The use of the LIF in the context of the MAPCON scenario simplifies the operations executed at the mobile device. The routing of flows to interfaces is achieved by means of the policies in the LIF layer and not according to the IP address destination. In this sense the routing operations at the MN are extremely simplified with respect to the extensive use of multiple interfaces and advanced routing capabilities. The granularity for routing can for instance be based on prefixes or flows, providing great flexibility to the LIF implementation and associated CM operations.

## [3.2.](#) Implementation Guidelines

### [3.2.1.](#) Policy management

LIF policies can be either pre-configured or dynamically configured on a host through some external protocol or function (e.g. OMA DM, IEEE 802.21 IS, etc). Normally, these policies MAY be configured and enforced onto the LIF by a Connection Manager (CM) [I-D.[draft-seite-mif-connection-manager](#)]. The CM SHOULD be in charge of managing the different sets of policies and enforcing them in a coherent manner.

The mapping between physical and virtual network interfaces and the

LIF SHOULD first follow the appropriate network-based policies and then the user-based policies. In this manner, network-based features such as IFOM can be supported.

### [3.2.2.](#) Interface configuration

A LIF MUST accept packets arriving on any of its sub-interfaces, as long as the destination IP address is a valid local address.

The LIF CAN by default bond all available sub-interfaces. However, if a policy is defined where only some interfaces are considered, for instance for IFOM purposes, the LIF SHOULD only bond the sub-interfaces defined in the policy.

When the link layer technology of the sub-interface encapsulates IP packets into frames, the link-layer identifier of the LIF SHOULD be used in the link-layer header of frames transmitted over this sub-interface.

### [3.2.3.](#) Flow mapping

In order for the LIF to support IFOM, independent flows need to be monitored at the LIF. Flows can be identified by a 5-tuple comprised of source address, destination address, source port, destination port

and protocol. Once a flow is identified, it is mapped to the sub-interface that has first been used to perform the packet transmission and reception functions for this specific flow. This mapping SHOULD be kept for the lifespan of the flow (e.g. TCP session).

For IPv6, the LIF MUST be aware of the hosted prefixes based on the received Router Advertisement (RA) messages. For instance, provided that RAs HNP1 are received on interface if1, any packet with source address generated using HNP1 SHOULD be forwarded through interface if1.

In case packets from a certain flow are suddenly received on a different sub-interface, an update to the flow mapping table COULD be done so that the corresponding packets are now forwarded through this new sub-interface. This case is especially needed to support the IFOM as described in [I-D.[draft-ietf-netext-logical-interface-support](#)].

## [4.](#) Security Considerations

This draft discusses the operations of existing protocols without modifications. It does not introduce new security threats beyond the current security considerations of PMIPv6 [[RFC5213](#)].

## [5.](#) IANA Considerations

This document makes no request of IANA.

## [6.](#) References

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