

## Graceful OSPF Restart Implementation Report

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### Abstract

Graceful OSPF Restart, as specified in RFC 3623, provides a mechanism whereby an OSPF router can stay on the forwarding path even as its OSPF software is restarted. This document provides an implementation report for this extension to the base OSPF protocol.

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## 1. Overview

Today, many Internet routers implement a separation of control and forwarding functions. Certain processors are dedicated to control and management tasks such as OSPF routing, while other processors perform the data forwarding tasks. This separation creates the possibility of maintaining a router's data forwarding capability while the router's control software is restarted/reloaded. For the OSPF protocol [OSPF], the protocol mechanisms necessary to accomplish this are described in Graceful OSPF Restart [GRACE].

This document satisfies the RFC 1264 [CRITERIA] requirement for a report on implementation experience for Graceful OSPF Restart. Section 2 of this document contains the results of an implementation survey. It also documents implementation differences between the vendors responding to the survey. Section 3 contains a MIB reference. Section 4 provide an authentication reference. Section 5 simply refers to the implementations listed in section 2. Section 6 includes a minimal set of test scenarios. Finally, section 7 includes a disclaimer with respect to operational experience.

## 2. Implementation Experience

Eleven vendors have implemented graceful OSPF and have completed the implementation survey. These include Redback, Juniper, Motorola Computer Group (formerly Netplane Systems), Mahi Networks, Nexthop technologies, Force10 Networks, Procket, Alcatel, Laurel Networks, DCL (Data Connection Limited), and Ericsson. All have implemented restart from the perspective of both a restarting and helper router. All but one vendor implemented both planned and unplanned restart. All implementations are original. Seven successfully tested interoperability with Juniper. Juniper successfully tested interoperability with Force10 Networks. One vendor tested with John Moy's GNU Public License implementation [OSPF-D]. Two vendors had not tested interoperability at the time of the survey.

### 2.1. Implementation Differences

The first difference was whether strict LSA checking was implemented and, if so, whether it was configurable. In the context of graceful OSPF restart, strict LSA checking indicates whether a changed LSA will result in the termination of graceful restart by a helping router. Four vendors made it configurable (three defaulted it to enabled and one to disabled), another made it a compile option (shipping with strict LSA checking disabled), another didn't implement it at all, and five implemented strict LSA checking with no configuration option to disable it.

The second was whether a received grace LSA would be taken to apply only to the adjacency on which it was received or to all adjacencies with the restarting router. This is a rather subtle difference since it only applies to helping and restarting routers with more than one full adjacency at the time of restart. Eight vendors implemented the option of the received grace LSA only applying to the adjacency on which it was received. Three vendors applied the grace LSA to all adjacencies with the grace LSA originator (i.e., the restarting router).

The final difference was in whether additional extensions were implemented to accommodate other features such as protocol redistribution or interaction with MPLS VPNs [VPN]. Five vendors implemented extensions and six did not. It should be noted that such extensions are beyond the scope of Graceful OSPF Restart [GRACE].

### 3. MIB Reference

MIB objects for the Graceful OSPF Restart have been added to the OSPF Version 2 Management Information Base [OSPFMIB]. Additions include:

- Objects `ospfRestartSupport`, `ospfRestartInterval`, `ospfRestartAge`, `ospfRestartExitReason`, and `ospfRestartStrictLsaChecking` to `ospfGeneralGroup`.
- Objects `ospfNbrRestartHelperStatus`, `ospfNbrRestartHelperAge`, and `ospfNbrRestartHelperExitReason` to `ospfNbrEntry`.
- Objects `ospfVirtNbrRestartHelperStatus`, `ospfVirtNbrRestartHelperAge`, and `ospfVirtNbrRestartHelperExitReason` to `ospfVirtNbrEntry`.

### 4. Authentication Mechanisms

The authentication mechanisms are the same as those implemented by the base OSPF protocol [OSPF].

### 5. List of Implementations

Refer to section 2.

### 6. Test Scenarios

A router implementing graceful restart should test, at a minimum, the following scenarios as both a restarting and helping router. For all scenarios, monitoring data plane traffic may be used to ensure that the restart is non-disruptive:

1. Operation over a broadcast network.
2. Operation over a P2P network.
3. Operation over a virtual link.
4. Operation using OSPF MD5 authentication.
5. Early graceful restart termination when an LSA inconsistency is detected.
6. Early graceful restart termination when a flooded LSA changes (if implemented).

## 7. Operational Experience

Since OSPF graceful restart is configurable, it is difficult to gage operational experience at this juncture. However, multiple service providers have tested and evaluated it.

## 8. Security Considerations

This document does not discuss implementation and interoperability aspects of the security mechanisms in great detail, as no new security mechanisms are introduced with Graceful OSPF Restart. Security considerations for the OSPF protocol are included in RFC 2328 [OSPF]. Security considerations for Graceful OSPF Restart are included in [GRACE].

## 9. Normative References

- [OSPF]      Moy, J., "OSPF Version 2", STD 54, RFC 2328, April 1998.
- [GRACE]      Moy, J., Pillay-Esnault, P., and A. Lindem, "Graceful OSPF Restart", RFC 3623, November 2003.
- [CRITERIA]      Hinden, R., "Internet Engineering Task Force Internet Routing Protocol Standardization Criteria", RFC 1264, October 1991.

## 10. Informative References

- [VPN]      Rosen, E. and Y Rekhter, "BGP/MPLS IP VPNs", Work in Progress, September 2003.
- [OSPFD]      Moy, J., "OSPF Complete Implementation", Addison-Wesley, 1991, ISBN 0-201-30966-1

[OSPFMIB]      Joyal, D., et al, "OSPF Version 2 Management Information Base", Work in Progress, December 2003.

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