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INFRASTRUCTURE, INTERNET PROTOCOL ASPECTS  
AND NEXT-GENERATION NETWORKS

Next Generation Networks – Frameworks and functional  
architecture models

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## Framework of multi-homing in IPv6-based NGN

Recommendation ITU-T Y.2052

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**GLOBAL INFORMATION INFRASTRUCTURE**

|                                           |             |
|-------------------------------------------|-------------|
| General                                   | Y.100–Y.199 |
| Services, applications and middleware     | Y.200–Y.299 |
| Network aspects                           | Y.300–Y.399 |
| Interfaces and protocols                  | Y.400–Y.499 |
| Numbering, addressing and naming          | Y.500–Y.599 |
| Operation, administration and maintenance | Y.600–Y.699 |
| Security                                  | Y.700–Y.799 |
| Performances                              | Y.800–Y.899 |

**INTERNET PROTOCOL ASPECTS**

|                                                                    |               |
|--------------------------------------------------------------------|---------------|
| General                                                            | Y.1000–Y.1099 |
| Services and applications                                          | Y.1100–Y.1199 |
| Architecture, access, network capabilities and resource management | Y.1200–Y.1299 |
| Transport                                                          | Y.1300–Y.1399 |
| Interworking                                                       | Y.1400–Y.1499 |
| Quality of service and network performance                         | Y.1500–Y.1599 |
| Signalling                                                         | Y.1600–Y.1699 |
| Operation, administration and maintenance                          | Y.1700–Y.1799 |
| Charging                                                           | Y.1800–Y.1899 |

**NEXT GENERATION NETWORKS**

|                                                                   |                      |
|-------------------------------------------------------------------|----------------------|
| <b>Frameworks and functional architecture models</b>              | <b>Y.2000–Y.2099</b> |
| Quality of Service and performance                                | Y.2100–Y.2199        |
| Service aspects: Service capabilities and service architecture    | Y.2200–Y.2249        |
| Service aspects: Interoperability of services and networks in NGN | Y.2250–Y.2299        |
| Numbering, naming and addressing                                  | Y.2300–Y.2399        |
| Network management                                                | Y.2400–Y.2499        |
| Network control architectures and protocols                       | Y.2500–Y.2599        |
| Security                                                          | Y.2700–Y.2799        |
| Generalized mobility                                              | Y.2800–Y.2899        |

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# **Recommendation ITU-T Y.2052**

## **Framework of multi-homing in IPv6-based NGN**

### **Summary**

Recommendation ITU-T Y.2052 describes a framework of multi-homing in Internet Protocol version 6 (IPv6)-based next generation network (NGN). This Recommendation identifies the requirements, the usage models, the functional architecture, and the applications of multi-homing in IPv6-based NGN.

### **Source**

Recommendation ITU-T Y.2052 was approved on 29 February 2008 by ITU-T Study Group 13 (2005-2008) under Recommendation ITU-T A.8 procedure.

### **Keywords**

IPv6, IPv6-based NGN, multi-homing.

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# CONTENTS

## Page

|      |                                                                         |    |
|------|-------------------------------------------------------------------------|----|
| 1    | Scope .....                                                             | 1  |
| 2    | References.....                                                         | 1  |
| 3    | Definitions .....                                                       | 1  |
| 3.1  | Terms defined elsewhere .....                                           | 1  |
| 3.2  | Terms defined in this Recommendation.....                               | 2  |
| 4    | Abbreviations and acronyms .....                                        | 2  |
| 5    | Conventions .....                                                       | 3  |
| 6    | Features of multi-homing in IPv6-based NGN.....                         | 3  |
| 7    | Requirements of multi-homing in IPv6-based NGN .....                    | 5  |
| 7.1  | General requirements of multi-homing in IPv6-based NGN .....            | 5  |
| 7.2  | Requirements of site multi-homing .....                                 | 5  |
| 7.3  | Requirements of host multi-homing.....                                  | 6  |
| 8    | Multi-homing models in IPv6-based NGN.....                              | 9  |
| 8.1  | Usage model of multi-homing in a network layer.....                     | 10 |
| 8.2  | Usage model of multi-homing in a transport layer.....                   | 11 |
| 9    | Functional architecture to support multi-homing in IPv6-based NGN ..... | 12 |
| 9.1  | Overall architecture to support multi-homing .....                      | 12 |
| 9.2  | Functional architecture to support multi-homing.....                    | 13 |
| 10   | Applications of multi-homing in IPv6-based NGN.....                     | 15 |
| 10.1 | Always-on connectivity.....                                             | 15 |
| 10.2 | Load sharing .....                                                      | 17 |
| 10.3 | Traffic engineering .....                                               | 17 |
| 10.4 | Fault tolerance with redundancy .....                                   | 18 |
| 10.5 | Session continuity across access networks.....                          | 19 |
| 11   | Security considerations.....                                            | 20 |
|      | Appendix I – Session continuity using multi-homing .....                | 21 |
|      | Bibliography .....                                                      | 23 |

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# Recommendation ITU-T Y.2052

## Framework of multi-homing in IPv6-based NGN

### 1 Scope

One of the primary features of Internet Protocol version 6 (IPv6) is 'multi-homing'. Using IPv6 multi-homing features, a network (or site) and/or a user terminal (or host) is able to have multiple network connections with multiple network interfaces and multiple IPv6 addresses. In IPv6-based next generation network (NGN), NGN users will have, using multi-homing features, always-on connectivity, improved fault tolerance, performance improvement by load balancing, and session continuity, etc.

This Recommendation describes a framework of multi-homing in IPv6-based NGN. For this purpose, this Recommendation identifies the requirements, the usage models, the functional architecture, and some applications of multi-homing so as to facilitate the deployment of the enhanced services in IPv6-based NGN.

The scope of this Recommendation includes:

- requirements of multi-homing in IPv6-based NGN;
- usage models of multi-homing in IPv6-based NGN;
- functional architecture to support multi-homing in IPv6-based NGN;
- applications of multi-homing in IPv6-based NGN.

### 2 References

The following ITU-T Recommendations and other references contain provisions which, through reference in this text, constitute provisions of this Recommendation. At the time of publication, the editions indicated were valid. All Recommendations and other references are subject to revision; users of this Recommendation are therefore encouraged to investigate the possibility of applying the most recent edition of the Recommendations and other references listed below. A list of the currently valid ITU-T Recommendations is regularly published. The reference to a document within this Recommendation does not give it, as a stand-alone document, the status of a Recommendation.

- [ITU-T Y.2012] Recommendation ITU-T Y.2012 (2006), *Functional requirements and architecture of the NGN release 1*.
- [ITU-T Y.2051] Recommendation ITU-T Y.2051 (2008), *General overview of IPv6-based NGN*.
- [ITU-T Y.2201] Recommendation ITU-T Y.2201 (2007), *NGN release 1 requirements*.
- [ITU-T Y.2701] Recommendation ITU-T Y.2701 (2007), *Security requirements for NGN release 1*.

### 3 Definitions

#### 3.1 Terms defined elsewhere

This Recommendation uses the following terms defined elsewhere:

**3.1.1 fault tolerance** [ITU-T E.800]: An attribute of an item that makes it able to perform a required function in the presence of certain given sub-item faults.

**3.1.2 IPv6-based NGN** [ITU-T Y.2051]: This refers to NGN that supports addressing, routing protocols and services associated with IPv6. An IPv6-based NGN shall recognize and process the

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IPv6 headers and options, operating over various underlying transport technologies in the transport stratum.

**3.1.3 session continuity** [b-ITU-T Q.1702]: The ability of the user to maintain continuity of ongoing sessions while changing between terminal devices and across various access and core networks.

## 3.2 Terms defined in this Recommendation

This Recommendation defines the following terms:

**3.2.1 always-on connectivity:** A capability that a NGN user or user equipment can connect to the networks at any time and at any place.

**3.2.2 host multi-homing:** A multi-homing feature that a host has multiple connections to networks.

**3.2.3 IPv6 multi-homing:** A feature of an IPv6 host and/or IPv6 network that enables the host or network to be multi-homed to networks through multiple network interfaces and multiple IPv6 addresses.

**3.2.4 IPv6 network provider:** An entity that provides IPv6 network connection by advertising IPv6 prefix information (e.g., ISP).

**3.2.5 load balancing:** A scheme by which the traffic load could be separated and balanced to effectively utilize the network resources (e.g., link bandwidth).

**3.2.6 network interface:** A device to be used by a node to connect to a network.

**3.2.7 site:** An entity autonomously operating a network using IP.

**3.2.8 site multi-homing:** A multi-homing feature that a site (network) has multiple connections to other networks.

## 4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

|        |                                              |
|--------|----------------------------------------------|
| BGP    | Border Gateway Protocol                      |
| DCCP   | Datagram Congestion Control Protocol         |
| DHCPv6 | Dynamic Host Configuration Protocol for IPv6 |
| FE     | Functional Entity                            |
| IPv4   | Internet Protocol version 4                  |
| IPv6   | Internet Protocol version 6                  |
| ISP    | Internet Service Provider                    |
| NACF   | Network Attachment Control Function          |
| NGN    | Next Generation Network                      |
| RACF   | Resource and Admission Control Function      |
| SCTP   | Stream Control Transmission Protocol         |
| TCP    | Transmission Control Protocol                |
| UDP    | User Datagram Protocol                       |

## 5 Conventions

None.

## 6 Features of multi-homing in IPv6-based NGN

The primary purpose of multi-homing is to provide multiple network connections to increase the reliability of network connections. Besides increasing reliability, the multi-homing feature enables the site and/or host to effectively utilize network connections to provide load balancing, session continuity, etc. In Internet Protocol version 4 (IPv4)-based networks, multi-homing is mainly deployed by using border gateway protocol (BGP) mechanism between network domains [b-IETF RFC 2260].

In IPv6-based NGN, multi-homing should be given more importance due to the following observations:

- A node has multiple IPv6 addresses for different scope and renumbering.
- A node has multiple network interfaces (physical interfaces by heterogeneous access networks and tunnelling interfaces).
- A node has multiple network prefixes for routing scaling.

IPv6 can provide a user terminal with multiple IPv6 addresses, which are allocated hierarchically by network providers. Although the purpose of multi-homing in IPv6-based NGN is the same as IPv4-based network, the requirements/considerations and mechanisms are different. In IPv6-based NGN, it disallows IPv4-style multi-homing [b-IETF RFC 2772].

- IPv6 network providers (e.g., Internet service provider (ISP)) cannot advertise prefixes of other network providers.
- Sites cannot advertise to upstream providers prefixes longer than their assigned prefix.

Because of these restrictions and the requirement of session continuity during the change of network connection by multi-homing, different mechanisms are needed for IPv6 multi-homing. The Internet Engineering Task Force (IETF) has carried out many studies for developing solutions, see [b-IETF RFC 3582], [b-IETF RFC 4116], [b-IETF RFC 4177], [b-IETF RFC 4218], [b-IETF RFC 4219].

In IPv6-based NGN, a NGN transport stratum comprises a wide variety of IPv6-based access networks and IPv6-based core network. IPv6-based access networks may be heterogeneous using different access technologies [ITU-T Y.2012]. Figure 1 shows an example of an IPv6-based NGN network architecture that consists of an IPv6-based core network and heterogeneous access networks which support IPv6-based IP connectivity. Those access networks use different access technologies and are interconnected with each other through IPv6-based core network.

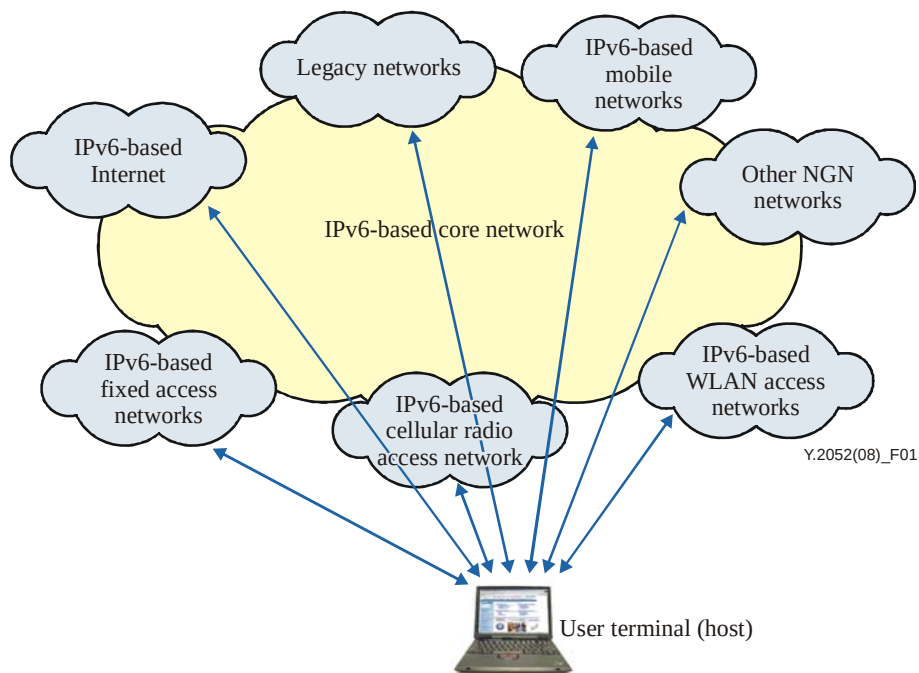


**Figure 1 – Overall configuration model of IPv6-based NGN**

In this configuration, a user terminal could use multiple IPv6 addresses and multiple network interfaces and be multiply connected to IPv6-based NGN. Also, each access network could use multiple network connections through multiple network prefixes. In this way, multi-homing features in IPv6-based NGN could be used to provide more enhanced services and connectivity for the users.

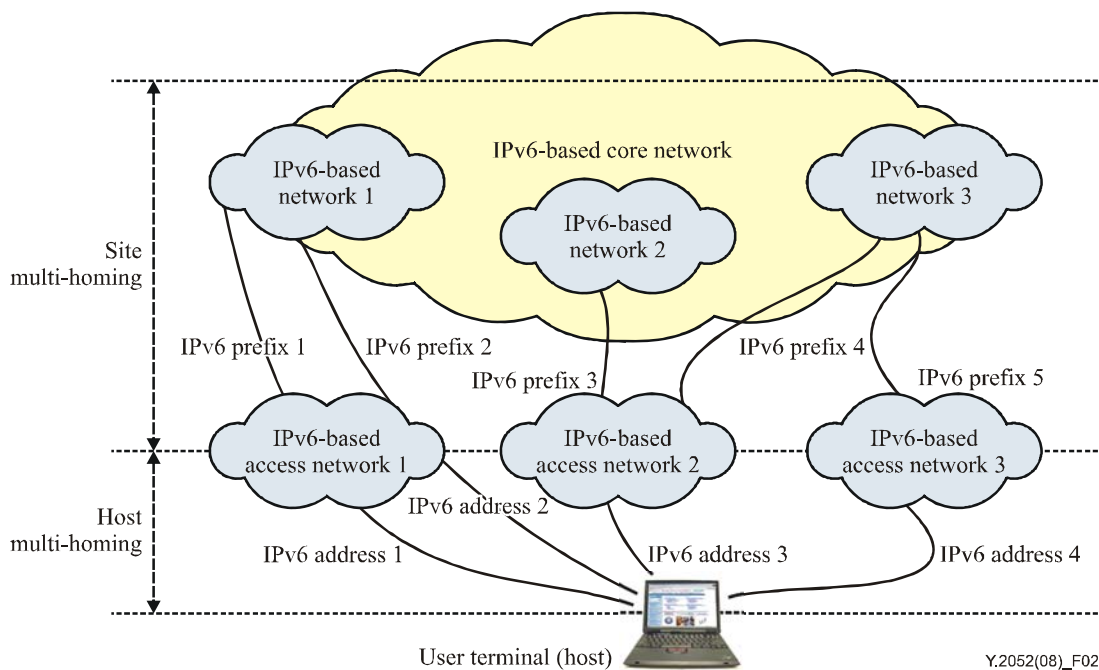


**Figure 2 – Example of multi-homing in IPv6-based NGN**