



ENABLING EFFICIENT AND OPERATIONAL MOBILITY IN LARGE HETEROGENEOUS IP NETWORKS

# MIPv6 bootstrapping and HA load sharing

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# Requirements for operational deployment of MIPv6

- Improvement of Mobile IPv6 scalability
  - Dynamic provisioning of configuration data on terminals and HAs
  - Load-sharing across HAs
- Improvement of reliability
  - Solutions for HA failover (no single point of failure)
- Control of mobility service
  - Service authorization based on a AAA infrastructure
- Enable offering of “premium” network features
  - On-demand and secure activation of fast handovers, QoS, etc.
- Integration of Mobile IPv6 in real-life environments
  - Coexistence with middle-boxes (firewalls, VPN concentrators, etc.)
  - Deployment of Mobile IPv6 in IPv4-only accesses

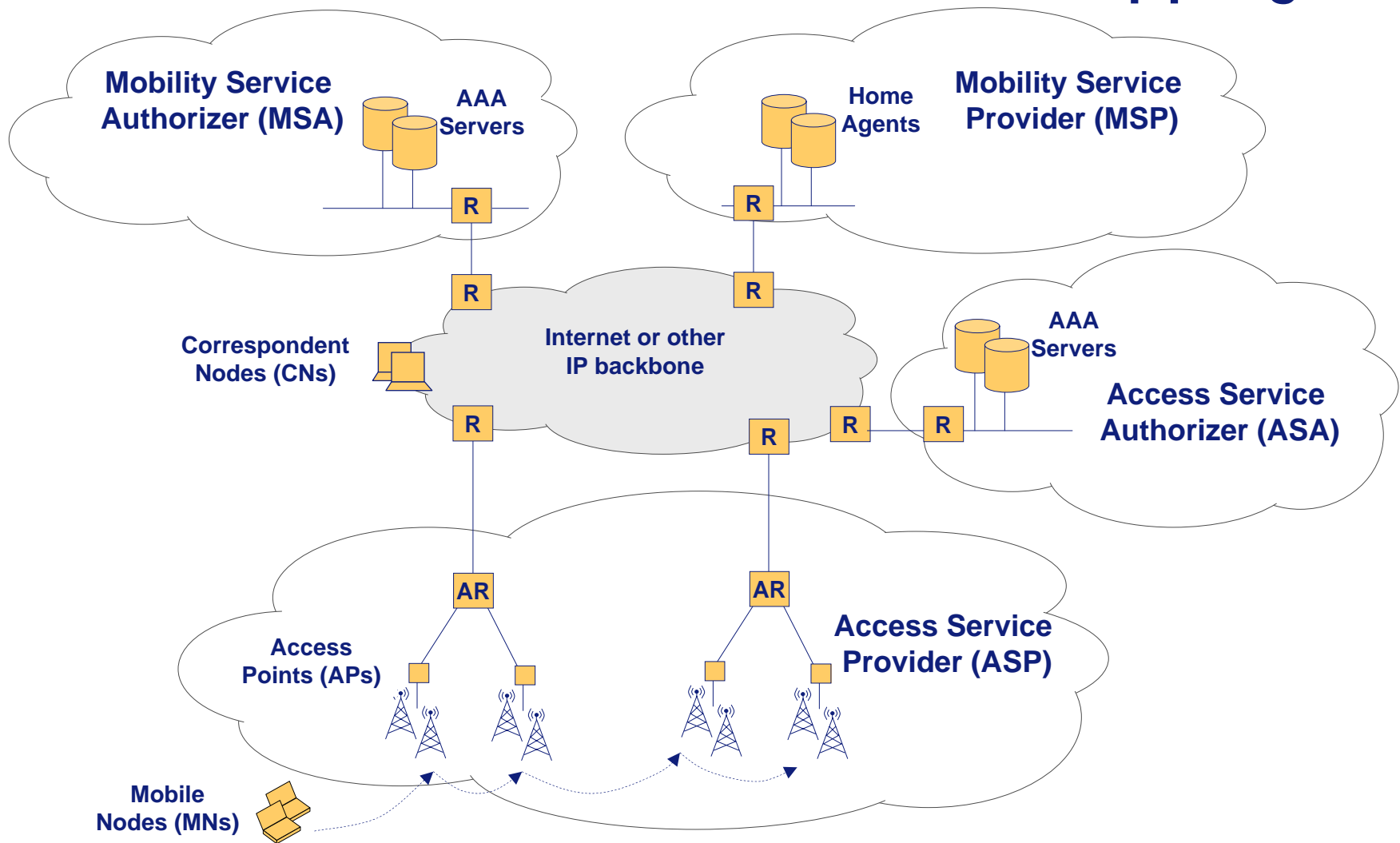


# Bootstrapping

- Goal
  - Addressing the operational requirement for dynamic provisioning of configuration data on terminals and HAs and MIPv6 service authorization
- Configuration data
  - HA address
    - Required on MN
    - Used for registering Binding Updates with HA
  - MN's Home Address
    - Required on MN
    - Used for communication with other nodes
    - Could change if home network change
  - Keying Material
    - Required on MN and HA
    - Used to set up a security association (IPsec, Authentication Protocol) between MN and HA



# Service entities involved in bootstrapping



## Bootstrapping architectures investigated by IETF

- Split scenario
  - Mobility Service Authorizer (MSA) is different from Access Service Authorizer (ASA)
  - Assignment of Home Agent done using DNS
- Integrated scenario
  - Mobility Service Authorizer (MSA) is the same as Access Service Authorizer (ASA)
  - Assignment of Home Agent done using DHCPv6



## Steps of the split scenario

- Getting network access
  - Using DHCPv6 or IPv6 stateless address autoconfiguration
- Home Agent assignment done by DNS request from MN
  - Requesting for a FQDN of a HA (e.g. ha.service-provider.com)
  - Requesting for a MIPv6 service (e.g. mip6.ipv6.service-provider.com)
- Setting up an IPsec security association between HA and MN
  - Use of Internet Key Exchange version2 (IKEv2) for this purpose
  - For this purpose the HA at the MSP has to contact the AAA service of the MSA for MN authentication and service authorization
- Assignment of a Home Address to MN
  - Done within the IKEv2 exchange
  - MN could propose a Home Address
- Update of the MN's DNS entry with the new Home Address
  - Triggering of DNS update within Binding Update from MN to HA
  - HA updates DNS directly or further delegates this to AAA

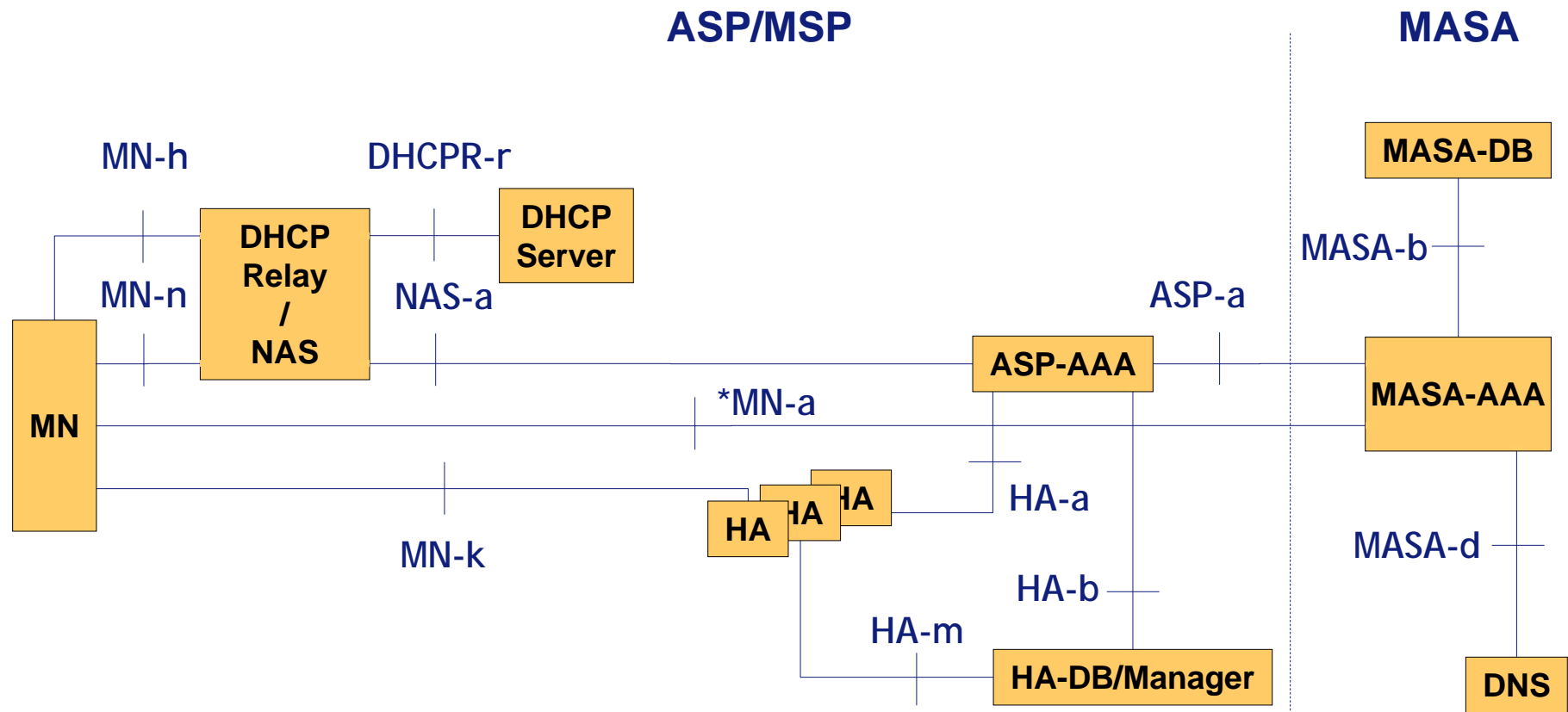


## Steps of the integrated scenario

- Getting network access
  - Using DHCPv6 or IPv6 stateless address autoconfiguration
- Home Agent assignment can be done in different ways
  - HA is always selected by the MSP
  - HA can be assigned in different ways
    - ❑ using DHCPv6
      - with support of EAP in access network
      - without support of EAP in the access network
    - ❑ using EAP to assign FQDN / IP address of HA in case DHCPv6 is not supported
  - ENABLE designs an architecture supporting several bootstrapping alternatives, the operator can select the most appropriate one
- Remaining steps identical to split scenario
  - Setting up an IPsec security association between HA and MN
  - Assignment of a Home Address to MN
  - Update of the MN's DNS entry with the new Home Address



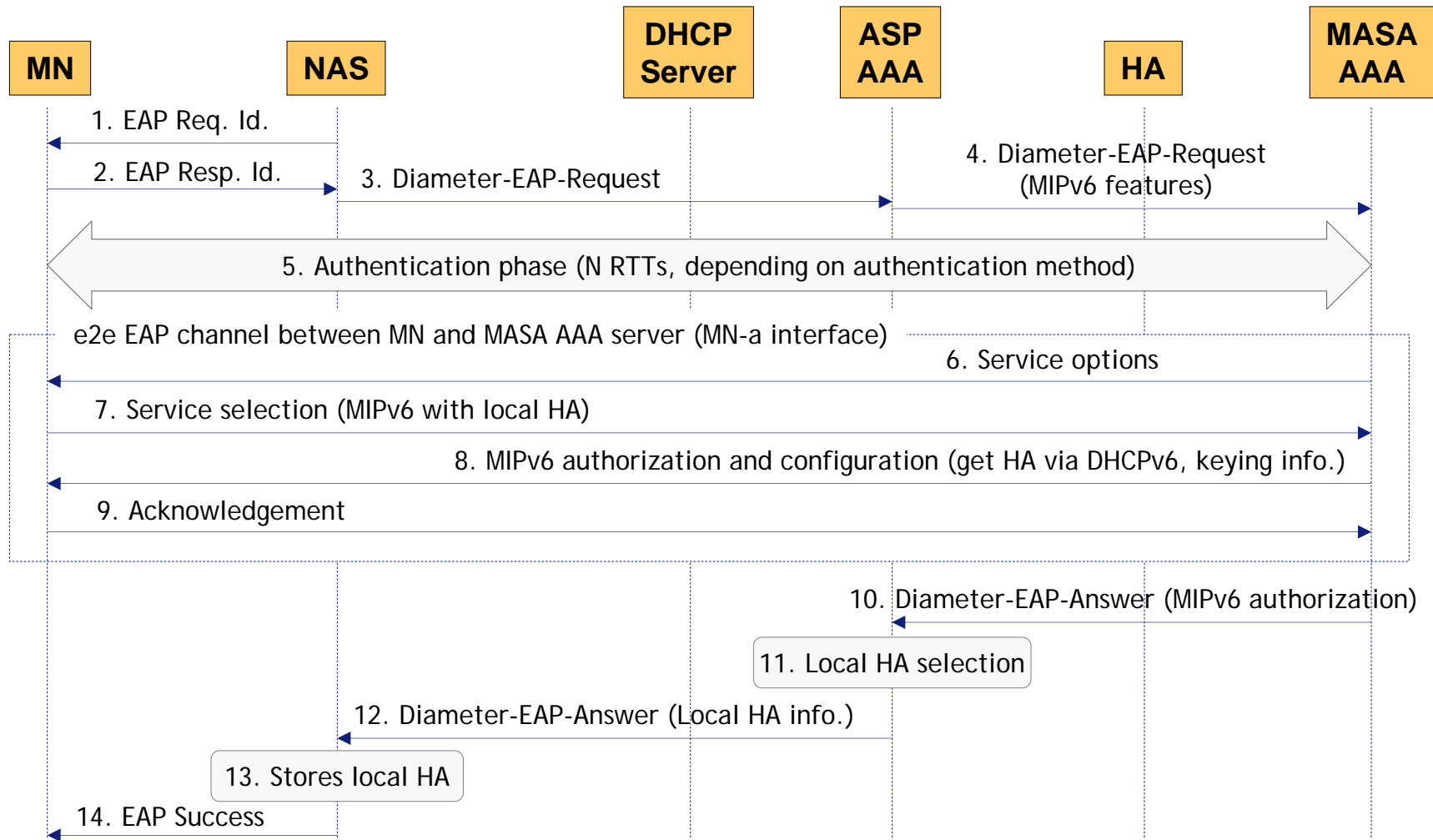
# Example architecture: Integrated scenario, ASP=MSP



\*MN-a logical interface

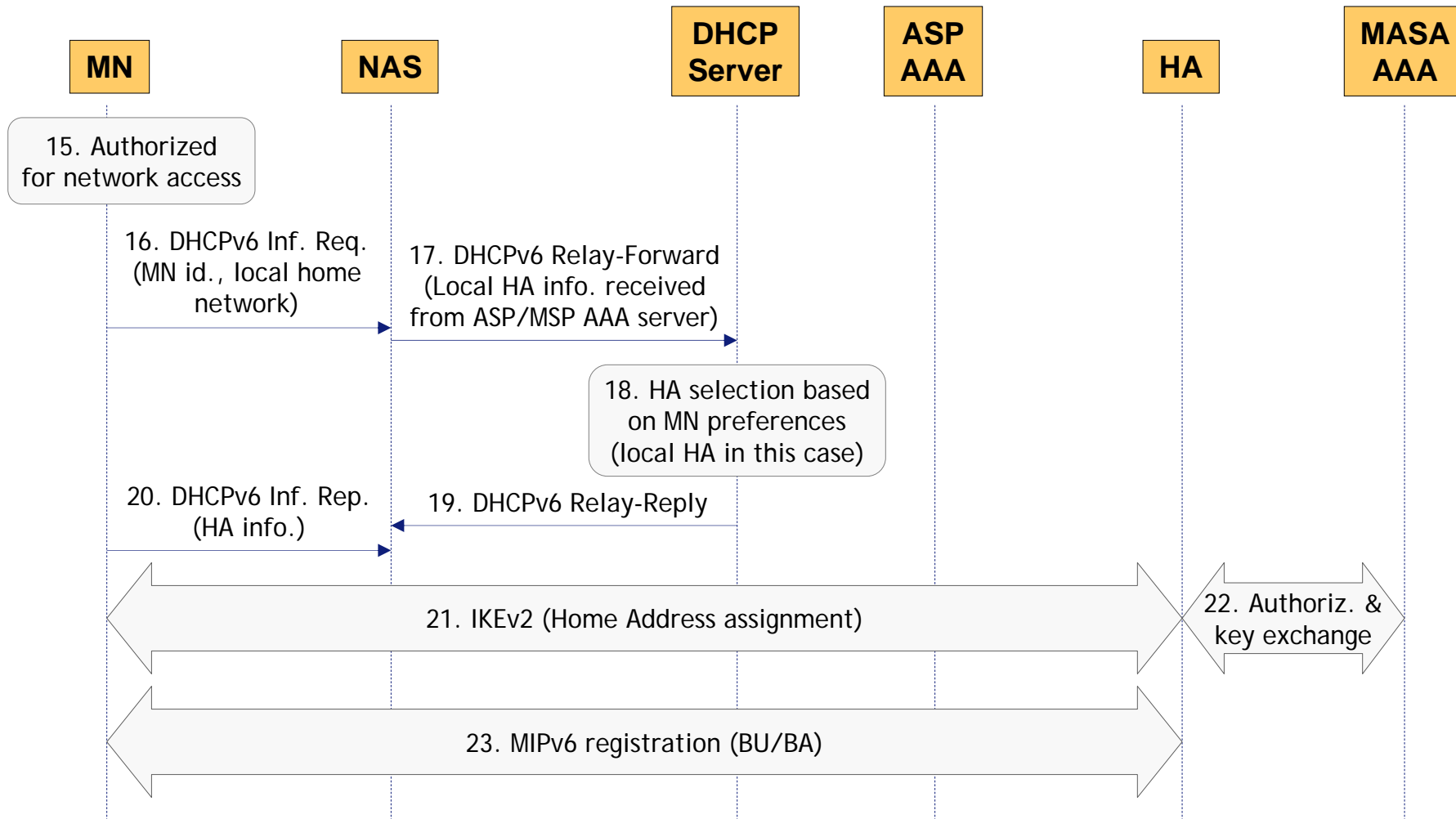


# Message flow: ASP=MSP, use of EAP (I)





# Message flow: ASP=MSP, use of EAP (II)



# Necessity of HA selection

- The MSP has to select a HA
  - during bootstrapping phase of the integrated scenario
  - during a HA relocation phase
    - ❑ possibility to achieve an optimized HA assignment during the bootstrapping phase of the split scenario
    - ❑ possibility to provide a close HA to moving MNs (local HA assignment)
    - ❑ possibility to substitute failing HAs
    - ❑ possibility to assign a HA meeting certain performance criteria
- This HA selection process allows a MSP to efficiently share the load between multiple HAs

## Components of a HA load sharing architecture

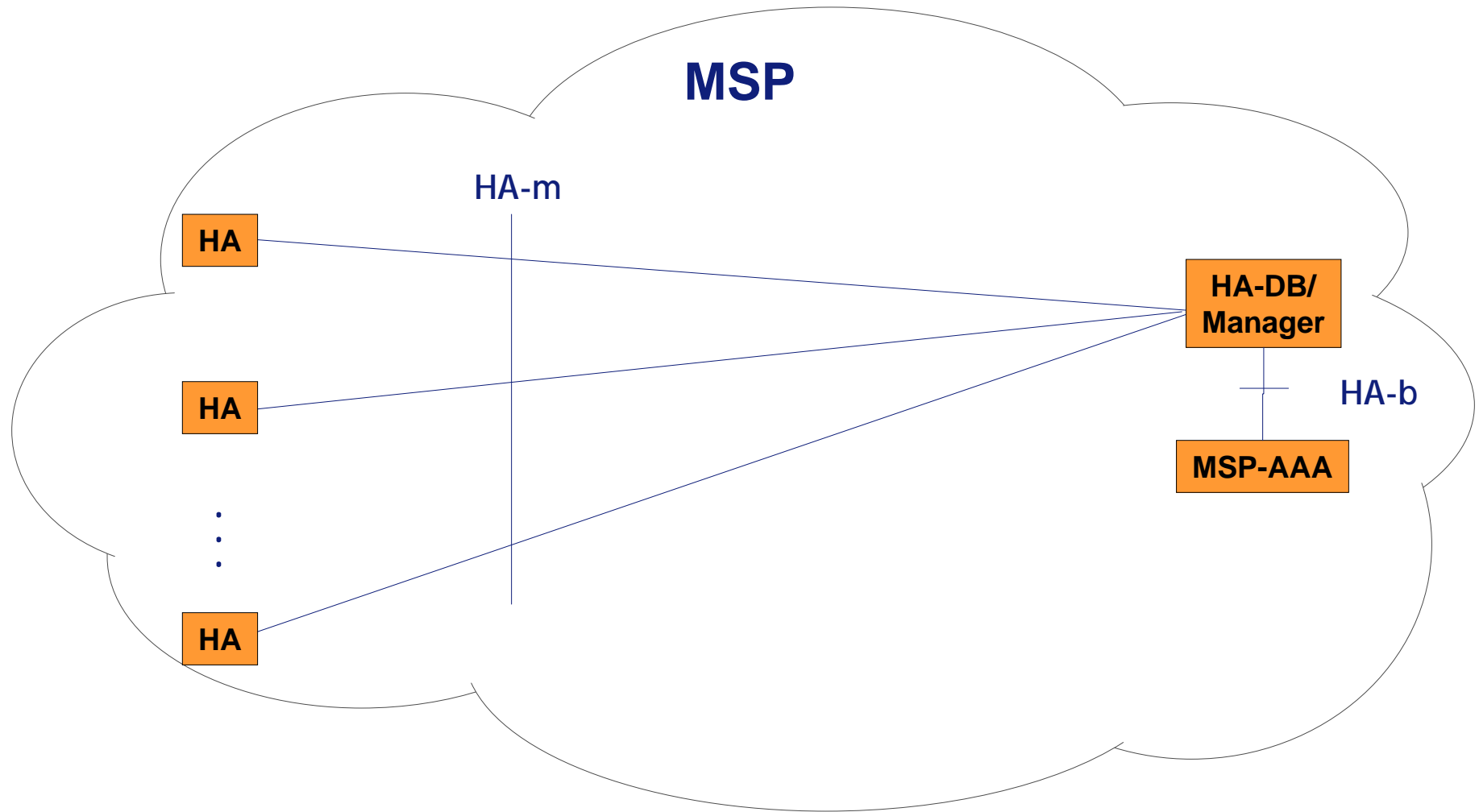
- Identification of a set of HA selection parameters measured on each HA
- Distributed collection of the selection parameters from the HAs
- Selection of the most suitable HA based on the collected selection parameters
- Assignment of the selected HA

## Identification of appropriate selection parameter

- The following, possible initial set of selection parameter has been identified by ENABLE:
  - number of active home registrations
    - ❑ The closer a HA gets to its maximal foreseen number of active home registrations, the less preferred it should be selected
  - current bandwidth availability at HA
    - ❑ The closer a HA gets to its maximal available bandwidth, the less preferred it should be selected
  - upcoming maintenance of HA
    - ❑ If there is a HA maintenance service upcoming, the HA shouldn't be selected
- The HA load sharing architecture will leave room for additional parameters, which are specific to some deployment/vendor/operator



## HA load sharing architecture of ENABLE





# Functional overview of HA load sharing

- HA-DB/Manager will
  - periodically collect selection parameters from each HA using e.g. SNMPv3 (HA-m interface)
- MSP-AAA will
  - access HA-DB/Manager for reading HAs selection parameters when needed using a data base protocol such as SQL or LDAPv3 (HA-b interface)
    - during bootstrapping
    - during HA relocation
  - calculate load for each HA (weighted sum of selection parameters) and finally select and assign the best HA
    - $m = a*x + b*y + c*z + \dots$ , with  $x, y, z, \dots$  being the selection parameters, and  $a, b, c, \dots$  being the weighting factors of the respective selection parameters
    - the setting of the weighting factors  $a, b, c$  is done by the MSP according to its specific policy

## Further information

- Visit ENABLE project website [www.ist-enable.com](http://www.ist-enable.com)
- Contact

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