Survey of IP address autoconfiguration mechanisms for MANETs

draft-bernardos-manet-autoconf-survey-00

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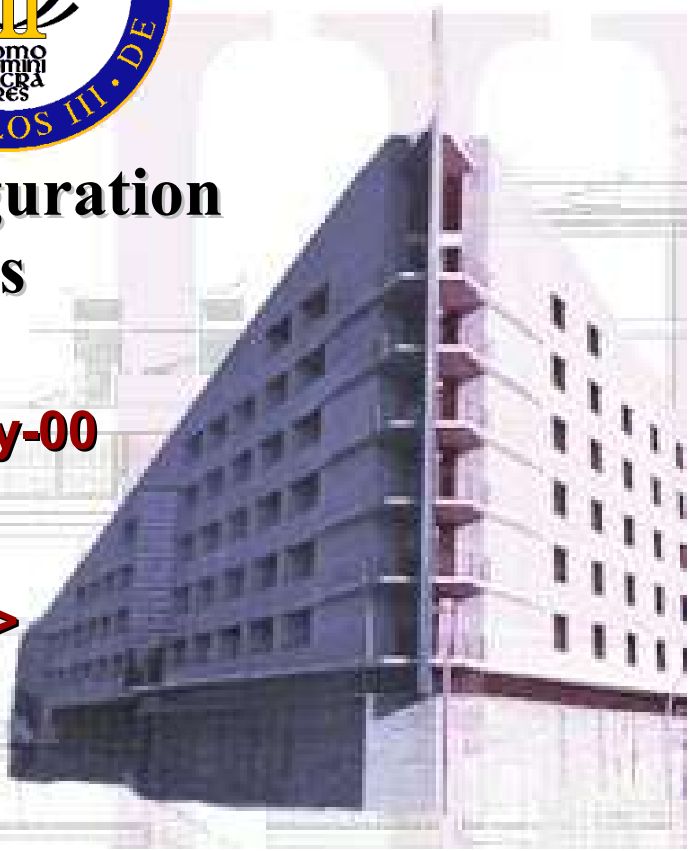
2005-08-01

63rd IETF – Paris



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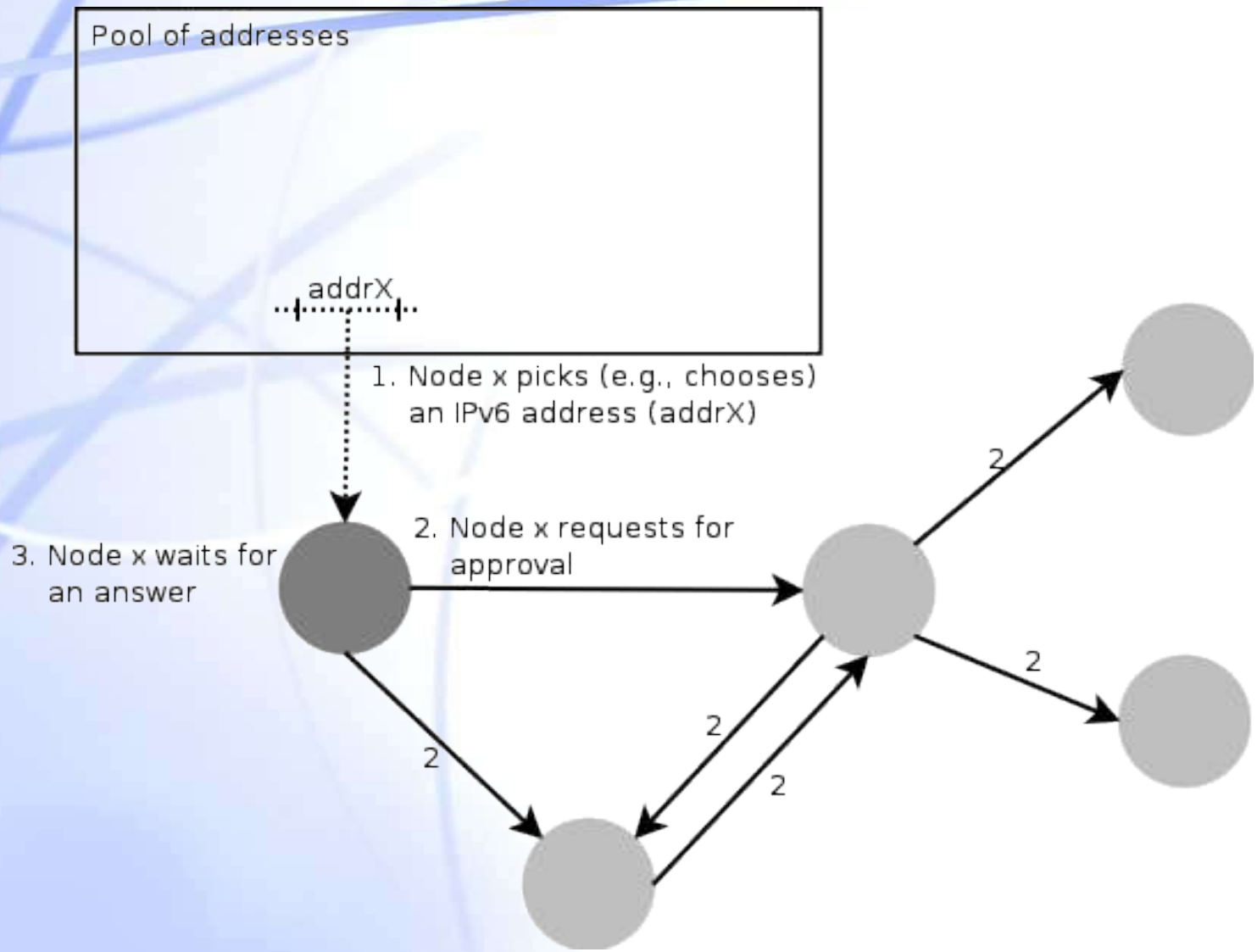
IP autoconfiguration in MANET

- There are several proposals
  - I-Ds and research papers
  - Different scopes / targets / applicability scenarios
    - IPv4 / IPv6 / IP family address independent
    - Ad-hoc routing protocol dependent / independent
    - Support for partitioning and merging
    - Duplicate Address Detection in MANETs
    - Centralised / Distributed
    - For Connected (hybrid) / Disconnected MANETs
    - Integrated or not with Internet-Gateway discovery
  - Many of the proposals try to solve just one piece of the general problem

Conflict-detection allocation



draft-perkins-manet-autoconf-01

- **Scope**
  - **Local IPv4/IPv6 address autoconfiguration**
  - **Ad-hoc routing protocol independent**
- **Basic mechanism**
  - **A node chooses an address randomly and performs Duplicate Address Detection (DAD) within the MANET**
  - **DAD within the MANET**
    - **Based on sending Address Request (AREQ) messages and waiting for Address Reply (AREP) messages (indicating that the address is already in use)**
    - **The node selects a temporary IP address (different to the requested one) as source of the AREQ messages**
      - This is used to create reverse routes at intermediate nodes
  - **Same mechanism for IPv4/IPv6**
    - **Modified Neighbour Solicitation and Advertisement for IPv6**
    - **New messages defined for IPv4**

draft-weniger-manet-addressautoconf-ipv6-00

- Scope
  - IPv6 address auto-configuration for MANETs
  - Ad-hoc routing protocol independent
- Basic mechanism
  - A hierarchy is established by special nodes (called leader nodes) that configure a group of nodes by issuing modified Router Advertisements within their scope, including a subnet ID (IPv6 prefix)
  - DAD is performed within the scope (limited area) of the node
  - The subnet ID has to be unique in the MANET to guarantee IPv6 address uniqueness
    - Duplicate Subnet ID Detection among leader nodes

draft-wakikawa-manet-globalv6-04

- Scope
  - Global IPv6 address auto-configuration for hybrid MANETs
  - Ad-hoc routing protocol independent
- Basic mechanism
  - There exists at least one Internet-Gateway (I-G) that sends proactively or reactively (in response to I-G solicitations) I-G advertisements that contain prefix information
    - Extended Router Solicitation/Advertisement messages or control messages for each MANET routing protocol can be used for this signalling
  - A node configures a global IPv6 address from the advertised prefix and the EUI-64 of the interface
    - No DAD for this address: it is assumed that the node has performed DAD for the link-local address

draft-jeong-adhoc-ip-addr-autoconf-04

- **Scope**
  - Local IPv4/IPv6 address autoconfiguration for disconnected MANETs
  - Ad-hoc routing protocol independent
  - Considers partitioning/merging
- **Basic mechanism**
  - Address autoconfiguration comprised of three steps
    - Selection of a random address
    - Verification of the address uniqueness (Strong DAD)
    - Assignment of the address to the interface
  - Besides Strong DAD during initialisation, intermediate routers also check for address duplication during ad-hoc routing (Weak DAD)
    - Virtual address concept: IP address + key (unique)
    - Node receiving an Address Error (AERR) message should autoconfigure a new IP address
  - New ICMPv4 and ICMPv6 messages defined for signalling (AREQ, AREP and AERR)
    - draft-jong-manet-aodv-addr-autoconf-01 defines the message format for AODV

draft-ruffino-manet-autoconf-multigw-00

- **Scope**
  - Global IPv6 address autoconfiguration for hybrid MANETs
  - Specified for OLSR, but can be generalised to other routing protocols
- **Basic mechanism**
  - There exist several gateways available in the MANET. Each of these gateways has a global IPv6 prefix that is announced using a new OLSR message type: Prefix Advertisement (PA)
  - At bootstrap, a node configures a (MANET-scoped) Primary Address (PADD) as main address in OLSR
    - The node receives PAs from the gateways in the MANET
  - With the prefix information from PAs, a node is able to build a set of global IPv6 addresses: Secondary Addresses (SADDs)
    - The node chooses the “best” prefix and start using the address formed from this prefix: Designated Secondary Address (DSADD)
    - The node introduces all (or a subset) of the SADDs in OLSR MID messages, enabling these addresses to be routable within the MANET
  - A generic DAD procedure should be performed to verify address uniqueness

draft-laouiti-manet-olsr-address-autoconf-01

- **Scope**
  - DAD for MANETs
  - Specified as an extension to OLSR
  - Supports partitioning/merging
- **Basic mechanism**
  - Each node in the MANET includes its IP addresses and a (randomly chosen) node identifier (assumed to be unique within the MANET) in a new OLSR control packet: Multiple Address Declaration (MAD)
  - Address conflict: MAD message received with same IP address and different identifier

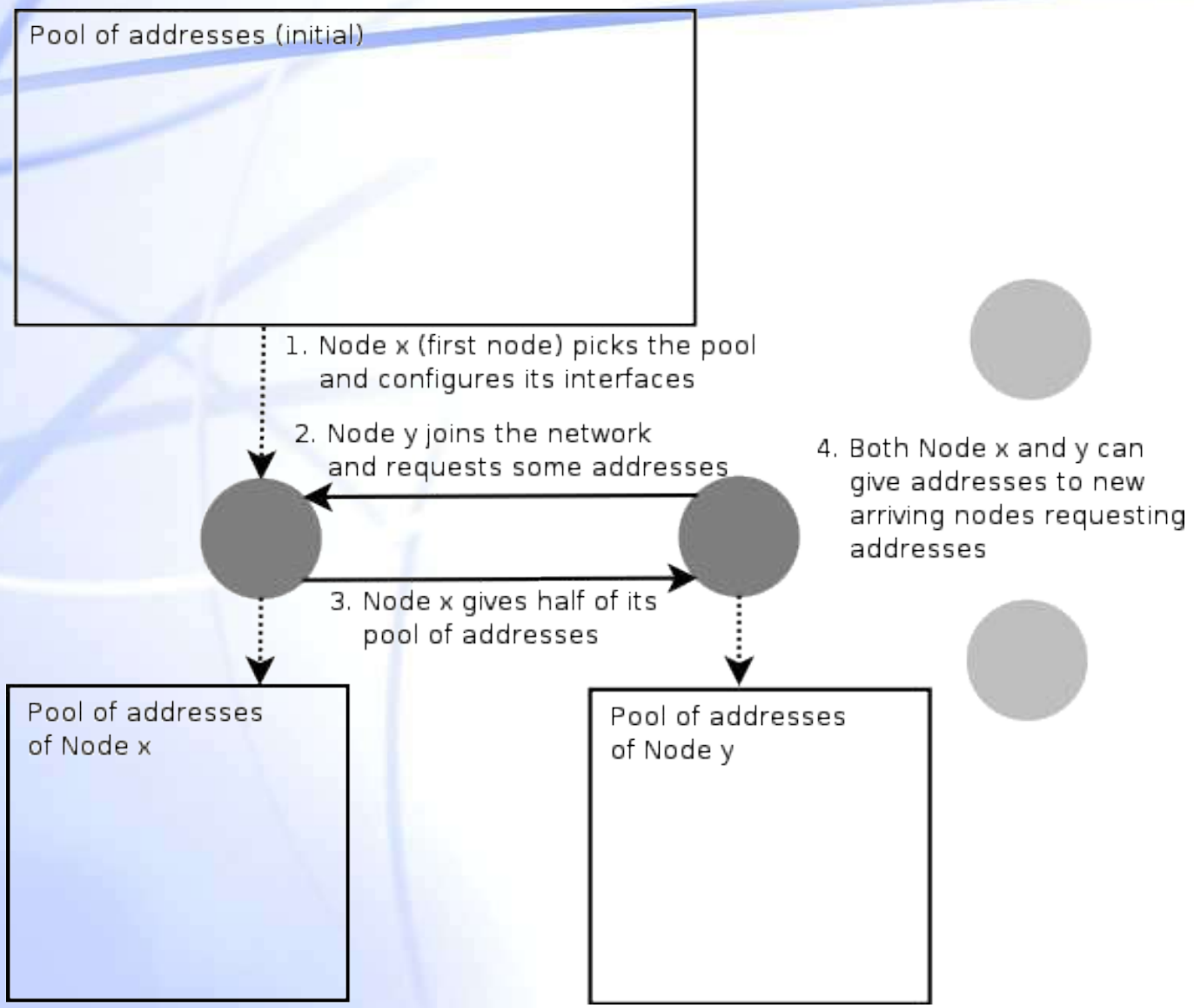
draft-singh-manet-mmg-00

- **Scope**
  - Global IPv6 address autoconfiguration for hybrid MANETs
  - Ad-hoc routing protocol independent
- **Basic mechanism**
  - The default gateway periodically sends modified Router Advertisements (RA)
    - Also in response to modified Router Solicitations
  - With the prefix information contained in the RAs, each MANET node configures a unique IPv6 address

draft-mase-manet-autoconf-noaolsr-00

- Scope
  - IPv6 address autoconfiguration for MANETs
  - Modification of the OLSR specification
- Basic mechanism
  - 3 parts
    - Address selection, based on the “busy address list”
    - Ongoing Duplicate Address Detection, using 10 simple rules, that can deal with the optimisation of OLSR
    - Gradual entry in OLSR network and routing table contamination avoidance, using three autoconfiguration states (HELLO, TOPOLOGY and NORMAL)

Conflict-free allocation



draft-clausen-manet-address-autoconf-00

- **Scope**
  - Global IPv6 address autconfiguration for hybrid MANETs
  - Specified for OLSR, but can be generalised to other routing protocols
- **Basic mechanism**
  - There exists at least one “configured” (e.g., an I-G) node in the MANET
  - The configured nodes periodically beacons ADDR_BEACON messages
  - A new node selects one configured node as its “configuring” node and sends an ADDR_CONFIG message to it, requesting a local address
  - The configuring node assigns a local address to the new node and signals it through another ADDR_CONFIG message
    - Now, the new node can start participating locally with the routing protocol
  - The configuring node acquires a global IP address (e.g., DHCP, autonomously) for the new node and signals it with an ADDR_CONFIG message

draft-jelger-manet-gateway-autoconf-v6-02

- **Scope**
  - **Global IPv6 address autoconfiguration for hybrid MANETs**
  - **Ad-hoc routing protocol independent**
- **Basic mechanism**
  - **Each gateway present in the MANET sends periodically GW_INFO messages, containing IPv6 global prefix information, to its one-hop neighbours**
    - **GW_INFO can be sent via control packets of an ad-hoc routing protocol or via UDP packets**
  - **Each node in the MANET selects one prefix for the configuration of its address (using the EUI-64)**
    - **The node forwards an updated version of the GW_INFO message that contains the selected prefix to its one-hop neighbours**
      - This way of propagation leads to “Prefix Continuity”
  - **DAD not performed since there is very low probability of address duplication**

non I-D proposals

- There are also several interesting proposals published as papers in conferences, journals, etc.
  - Some of them introduce concepts and mechanisms that are afterwards reused by some of the existing I-D mechanisms
  - Interesting conflict-free allocation approaches
  - References to these papers can be found in the draft