# Selected IPv6 topics in cellular: *MIF, Prefix Delegation, NAT64*

Workshop on TCP+VoIP, congestion control, new web developments, and selected IPv6 topics in cellular 15th October 2012 / Helsinki

Teemu Savolainen (teemu.savolainen@nokia.com) Nokia Research Center



## Multiple interface issues

Arise when a host is truly connected to multiple accesses simultaneously

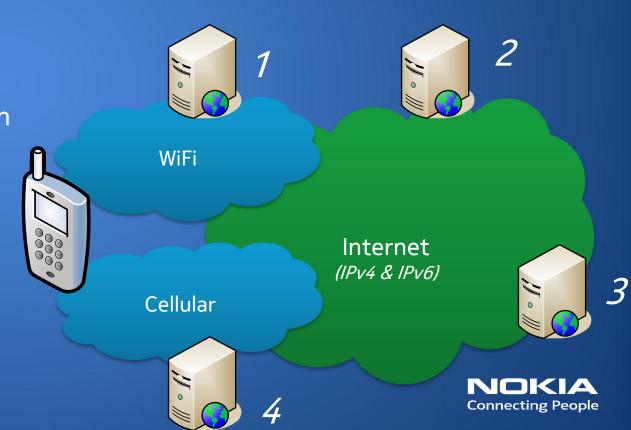
Our focus was AFTER network selections have been made (e.g. with ANDSF)

#### RFC 6418 lists these problems, some are:

- How to select DNS server in split-DNS case
- How to select optimal interface for a destination
- How to select right addresses
- How to control via APIs

#### MIF is working on solutions:

- DNS selection to be RFC soon
- DHCPv6 rule distribution facing headwind
- API / Happy Eyeballs not followed really...



#### Improved Recursive DNS Server Selection

Soon RFC 6731

#### Supports both DHCPv6 and DHCPv4

```
Enterprise
                    | RDNSS with
                    | public +
                    enterprise's
     MIF
node l
     |---- WLAN ----| RDNSS with
                    | public names
                                        Internet
     ---- cellular ---| RDNSS with
                    | public +
                                        Operator
                    | operator's
                                        Intranet
                    | private names
```

Referenced already from "IPv6 Multihoming without Network Address Translation", draft-ietf-v6ops-ipv6-multihoming-without-ipv6nat-04

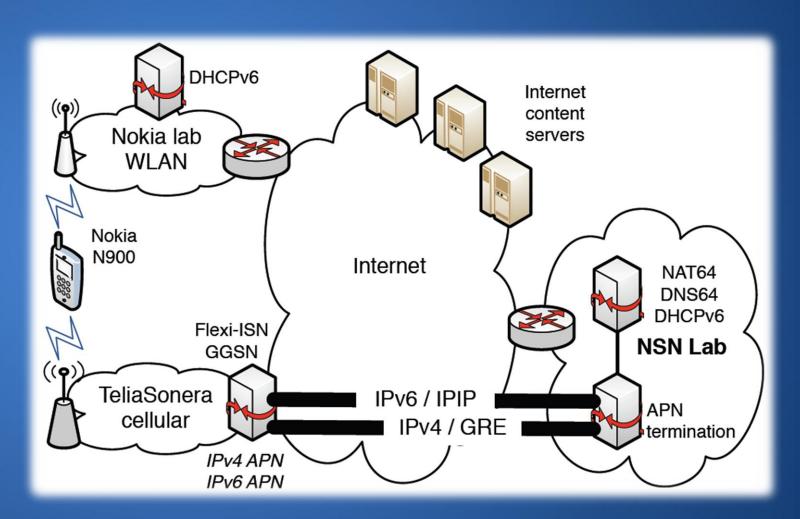
### IPv6 traffic offloading using DHCPv6

Our implementation  $\rightarrow$ 

DHCPv6 servers providing rules in WLAN and cellular

DHCPv6 served both routes and DNS server selection rules

Modified N900 used (with ISC's DHCPv6 client & BIND, some scripts and utilities)





## **IPv6 Prefix Delegation**

Started by thinking about stateless prefix delegation – that went nowhere

Ended on DHCPv6 Prefix Delegation Exclude Option RFC 6603

..excludes a prefix out of a delegated prefix

Enables aggregation of the bearer's /64 prefix and the delegated prefix into a single aggregared prefix

Successfully contributed to 3GPP!



## NAT64 discovery and learning NAT64 prefix

NAT64s are becoming reality – also in 3GPP networks

Hosts may want to choose whether to use interface with NAT64, or one without

NAT64 has to be discovered

Once discovered, as "side-product", the learned prefix can be used in local IPv6 address synthesis!

-> already used in double translation: draft-ietf-v6ops-464xlat

IPv4-only service NAT64 internet Mobile **GGSN** handset **Dual-stack** IPv6 PDP context Operator service core IPv6 NAT46 internet IPv6-only **DNS64** 



#### NAT64 discovery and learning NAT64 prefix

```
Node
                                        DNS64 server
     "AAAA" query for "ipv4only.arpa"
    ----->| "A" query for "ipv4only.arpa"
                                               "A" response: "192.0.0.170" & "192.0.0.171"
                                "AAAA" synthesis using two Pref64::/n.
      "2001:db8:42::192.0.0.170"
      "64:ff9b::192.0.0.170"
responses at this point and skip the steps below.
     "PTR" query #1 for "2001:db8:42::192.0.0.170
     "PTR" response #1 "nat64 1.example.com"
| Compare received domains to a trusted domain list and if matches are found, continue.
     "AAAA" query #1 for "nat64 1.example.com"
   |---->
   | "AAAA" resp. #1 with "2001:db8:42::192.0.0.170
    <-----
 | Validate AAAA responses and compare the IPv6 addresses to those previously learned.
  Fetch the Pref64::/n from the validated responses and take into use.
```



## Thank you

