RFC8273

Unique IPv6 Prefix per Host

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Jordi Palet (jordi.palet@theipv6company.com)

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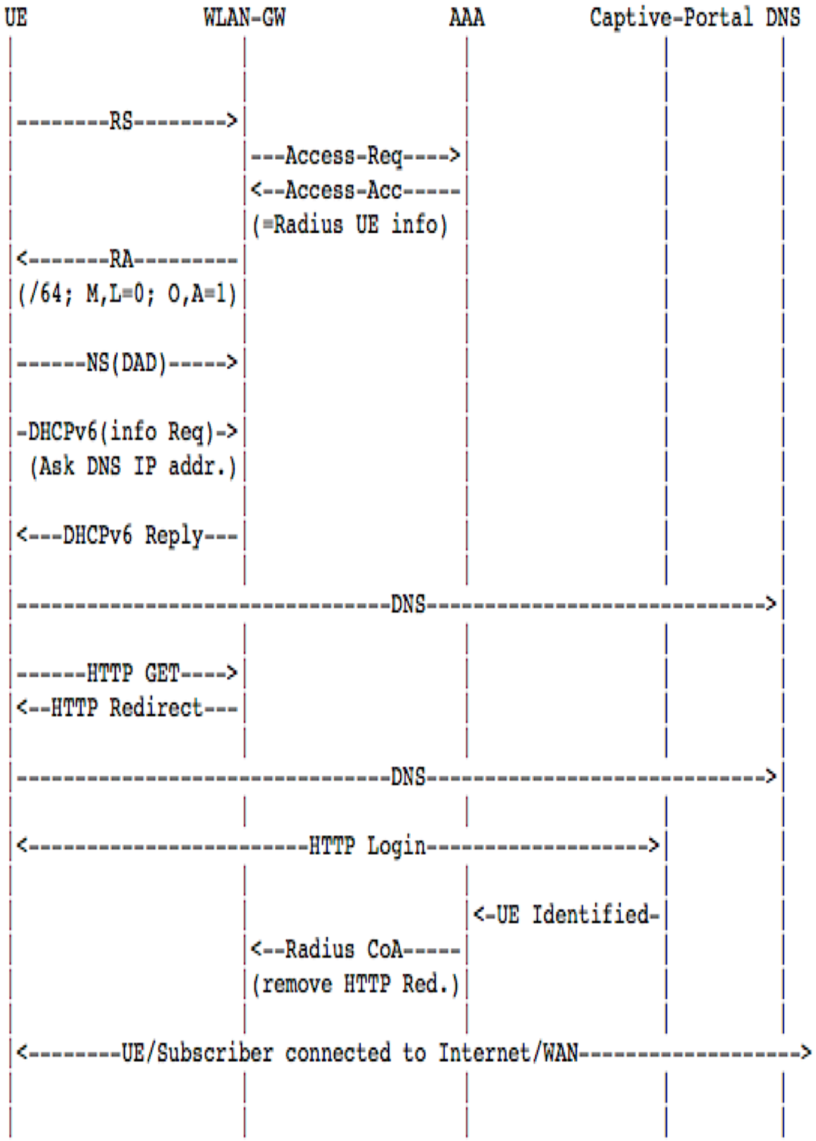
- RFC8273: “Unique IPv6 Prefix per Host”

- Not a “new” protocol, so already widely supported
  - **Use “existing IPv6 protocols” to allow a unique IPv6 prefix (instead of a unique IPv6 address from a shared IPv6 prefix) to be assigned to a host interface**

- Allows improved host isolation and enhances subscriber management on shared network segments, such as Wireless networks, data centres, among others

- Provides a very simple mechanism for a single host or interface, to be able to run 2^{64} virtual machines, with their own global IPv6 address, not requiring to share a single one

“How To”



```
UE                WLAN-GW           AAA          Captive-Portal  DNS
 |                   |                |                 |          |
 |                   |                |                 |          |
 |--------RS-------->|                |                 |          |
 |                   |---Access-Req-->|                 |          |
 |                   |<--Access-Acc---|                 |          |
 |                   |(=Radius UE info)                 |          |
 |<--------RA--------|                |                 |          |
 |(/64; M,L=0; O,A=1)|                |                 |          |
 |                   |                |                 |          |
 |------NS(DAD)----->|                |                 |          |
 |                   |                |                 |          |
 |-DHCPv6(info Req)->|                |                 |          |
 | (Ask DNS IP addr.)|                |                 |          |
 |                   |                |                 |          |
 |<---DHCPv6 Reply---|                |                 |          |
 |                   |                |                 |          |
 |-------------------------------DNS---------------------------->|
 |                   |                |                 |          |
 |------HTTP GET---->|                |                 |          |
 |<--HTTP Redirect---|                |                 |          |
 |                   |                |                 |          |
 |-------------------------------DNS---------------------------->|
 |                   |                |                 |          |
 |<-----------------------HTTP Login------------------->|          |
 |                   |                |                 |          |
 |                   |                |<-UE Identified-|          |
 |                   |<--Radius CoA---|                 |          |
 |                   |(remove HTTP Red.)                |          |
 |                   |                |                 |          |
 |<--------UE/Subscriber connected to Internet/WAN------------------>
 |                   |                |                 |          |
 |                   |                |                 |          |
```

1. First-hop router is a L3 edge router
2. UE connects to the shared-access network and starts IP configuration with SLAAC RS
3. First-hop router sends solicited RA response ONLY to the requesting UE
   - Instead of using the link-layer multicast address (all-nodes group), using the link-layer unicast address of the requesting UE
   - The solicited RA contains the unique prefix (/64) and flags (to indicate if SLAAC and/or DHCPv6 should be used, etc.)
   - Prefix from locally/centrally managed pool, aggregate IPv6 block, …
   - Flags, best practices:
     - M-flag = 0 (address not managed with DHCPv6, 1 for DHCPv6 prefix delegation)
     - O-flag = 1 (DHCPv6 used for other configuration information)
     - A-flag = 1 (UE can configure itself using SLAAC)
     - L-flag = 0 (prefix is not an on-link prefix, everything sent to the gateway)
4. Periodically unsolicited RAs follow same approach

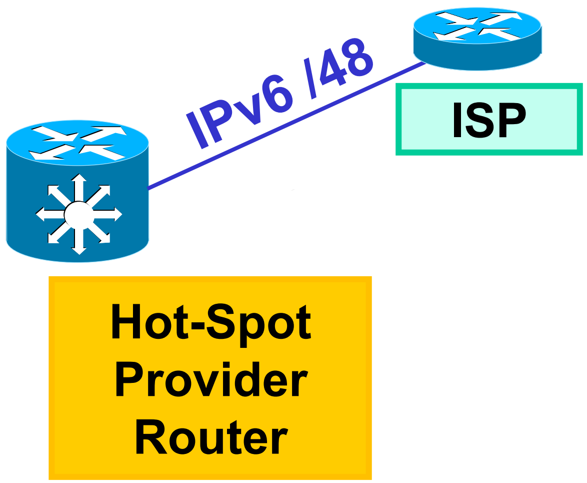
Usage Scenarios

- We are already doing in cellular:
  - /64 per PDP context
  - Prefix sharing with other devices (tethering)
  - Facilitate IPv6-only access (and IPv4-as-a-service)
- Allows extending same concept to other scenarios:
  - Hot-Spot
    - WiFi Calling: Secured Voice over WiFi over “untrusted” connection
      - IPv4 or IPv6 IPsec tunnels to the ePDG (evolved Packet Data Gateway)
  - Corporate networks
  - Data Center
- Allows also IPv6-only access and IPv4-as-a-service
  - Same concept as above for WiFi Calling
    - VPN “on demand” in “own” network for IPv4 services
    - No need for NAT44 (lowers logging costs and fragmentation issues)

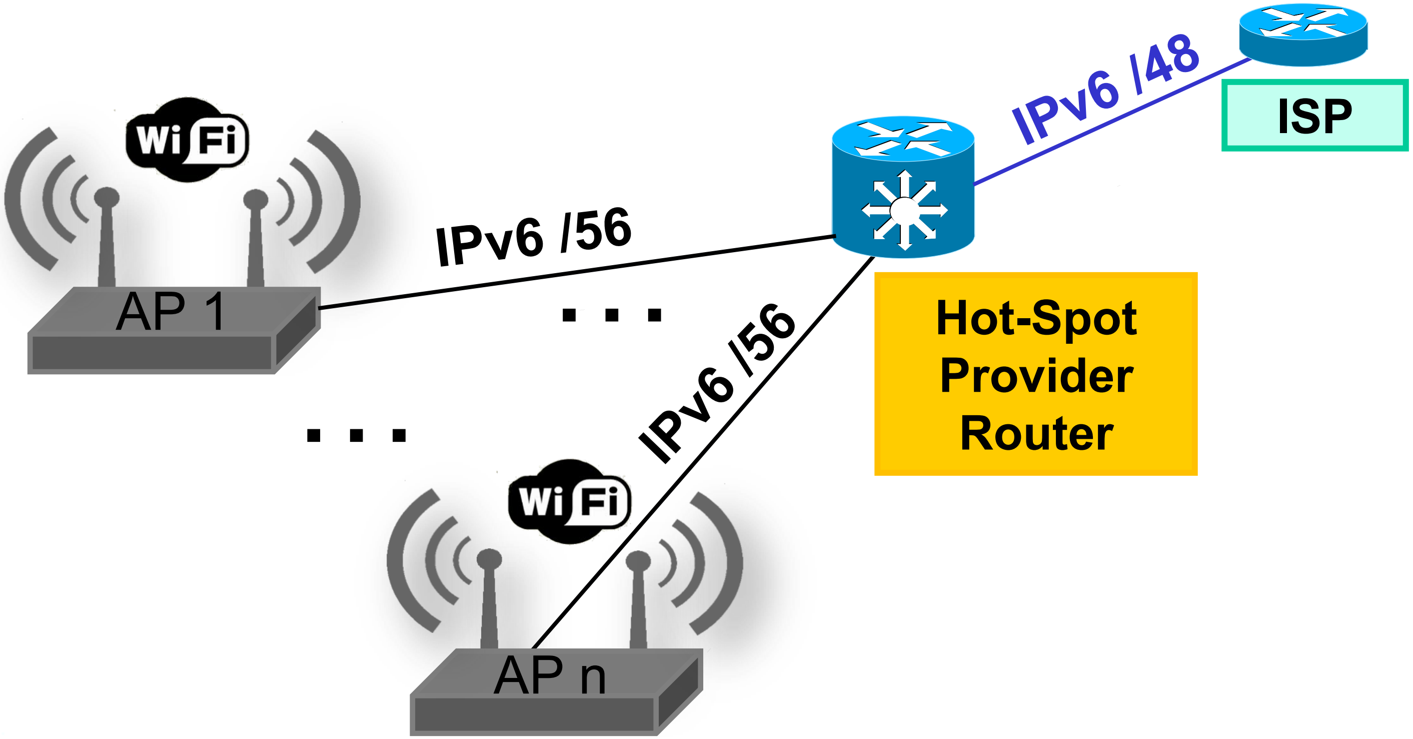
Hot-Spot Usage

- WiFi shared-access L2 network
- Provide isolation between user devices either due to legal requirements or to avoid potential abuse
- By using "unique IPv6 prefix per host", devices only can communicate thru the first-hop router
- Automatically avoids attacks based on link-local ICMPv6:
  - DAD reply spoofing
  - ND cache exhaustion
  - Malicious redirects
  - Rogue RAs
- Better scalability and robustness than DAD proxy, forced forwarding, ND snooping, etc.

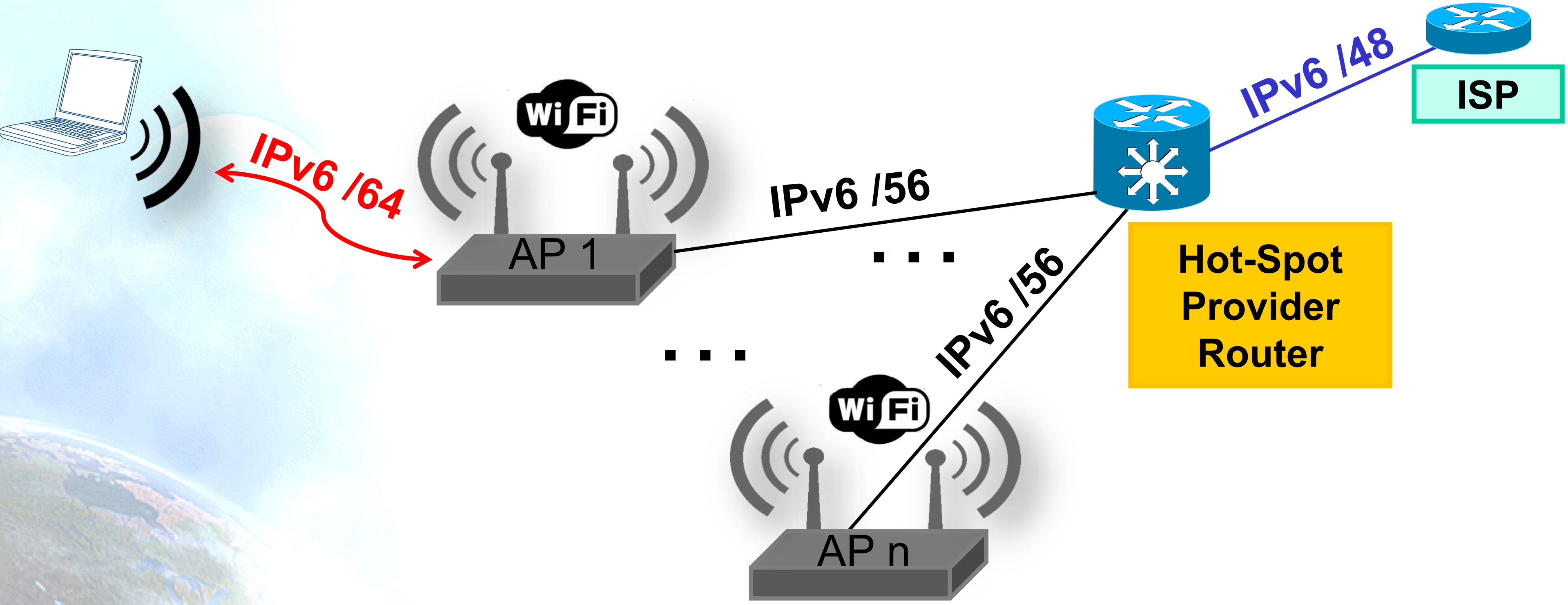
Hot-Spot Example



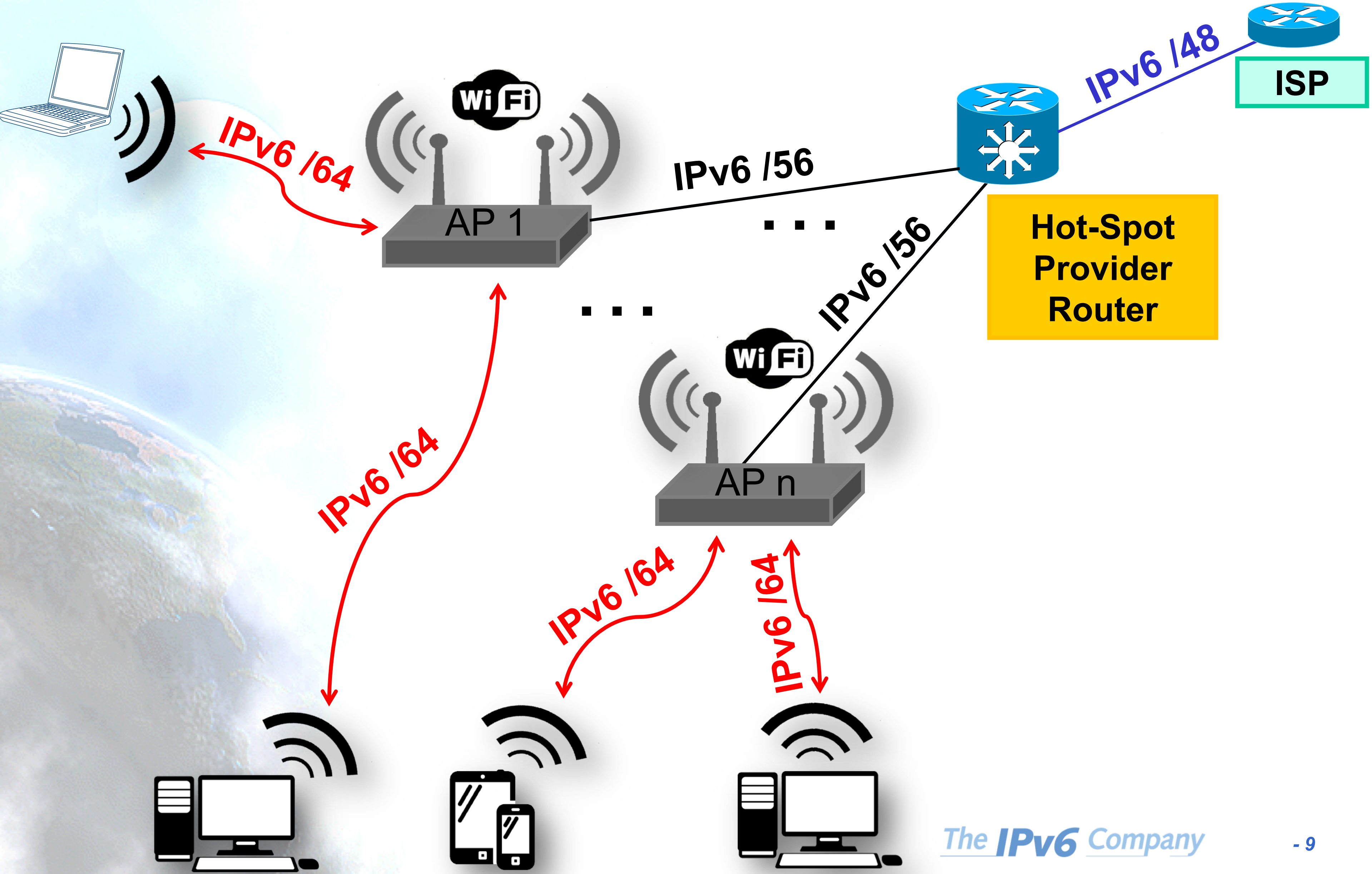
Hot-Spot Example



Hot-Spot Example



Hot-Spot Example



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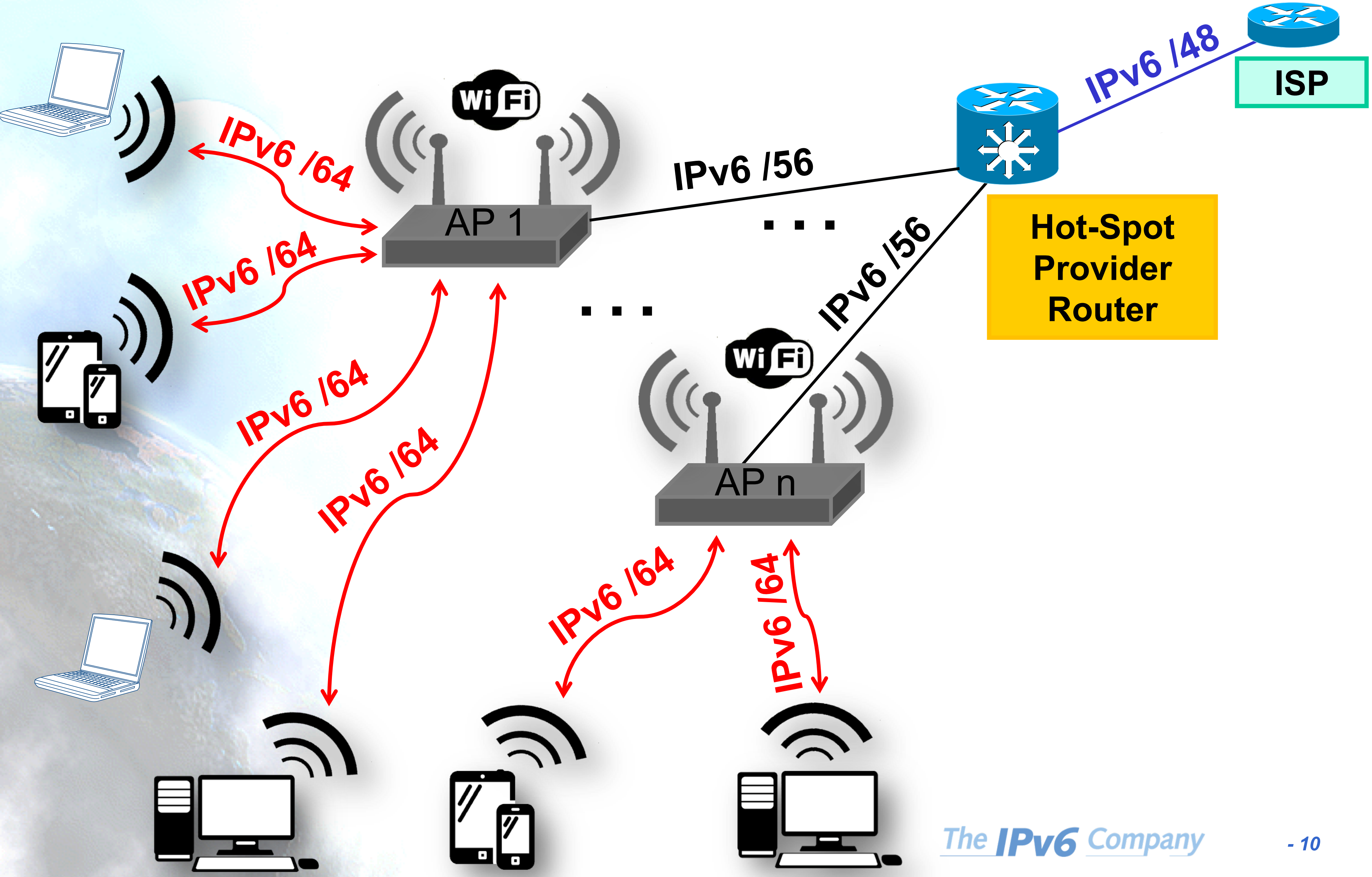
Hot-Spot Example



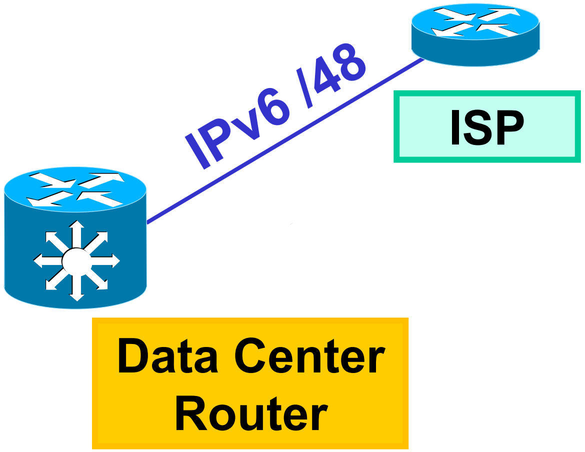
Data Centre Usage

- "How to" same as for the Hot-Spot case

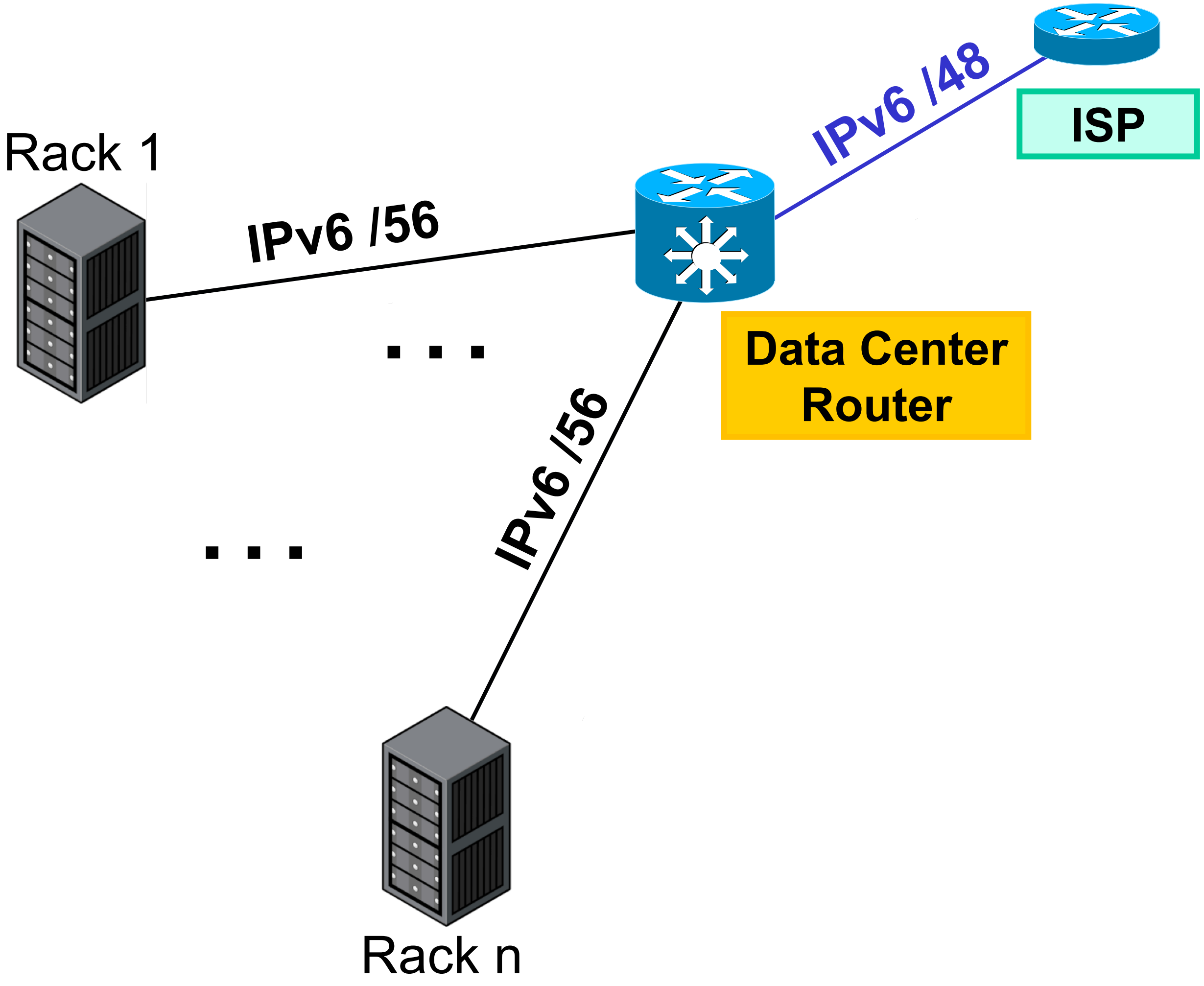
- The UE "server" may need multiple addresses from the same unique IPv6 prefix (VMs, containers), so just need to configure them

- The first-hop router must be able to handle the presence and use of those

Data Center Example



Data Center Example



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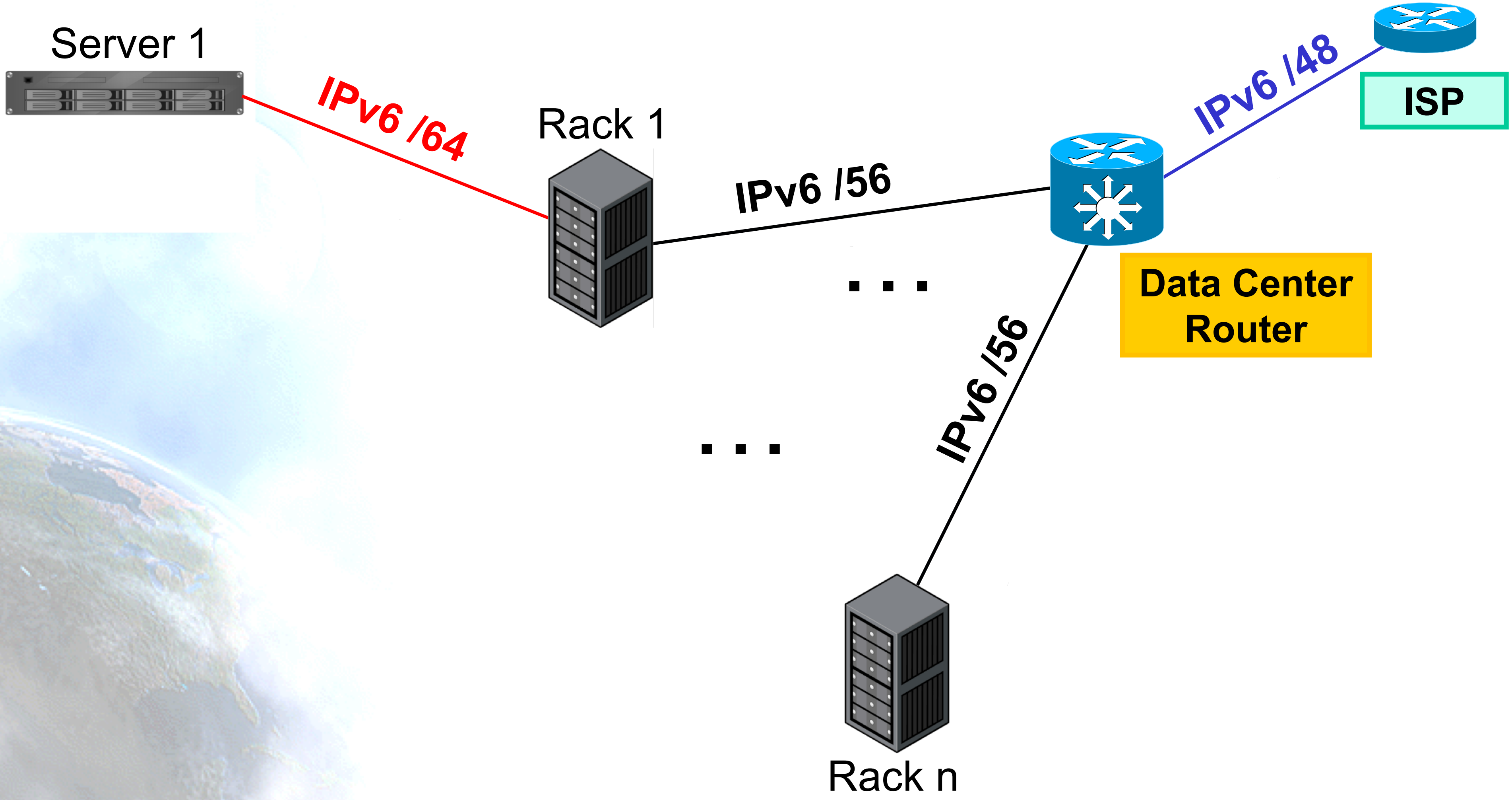

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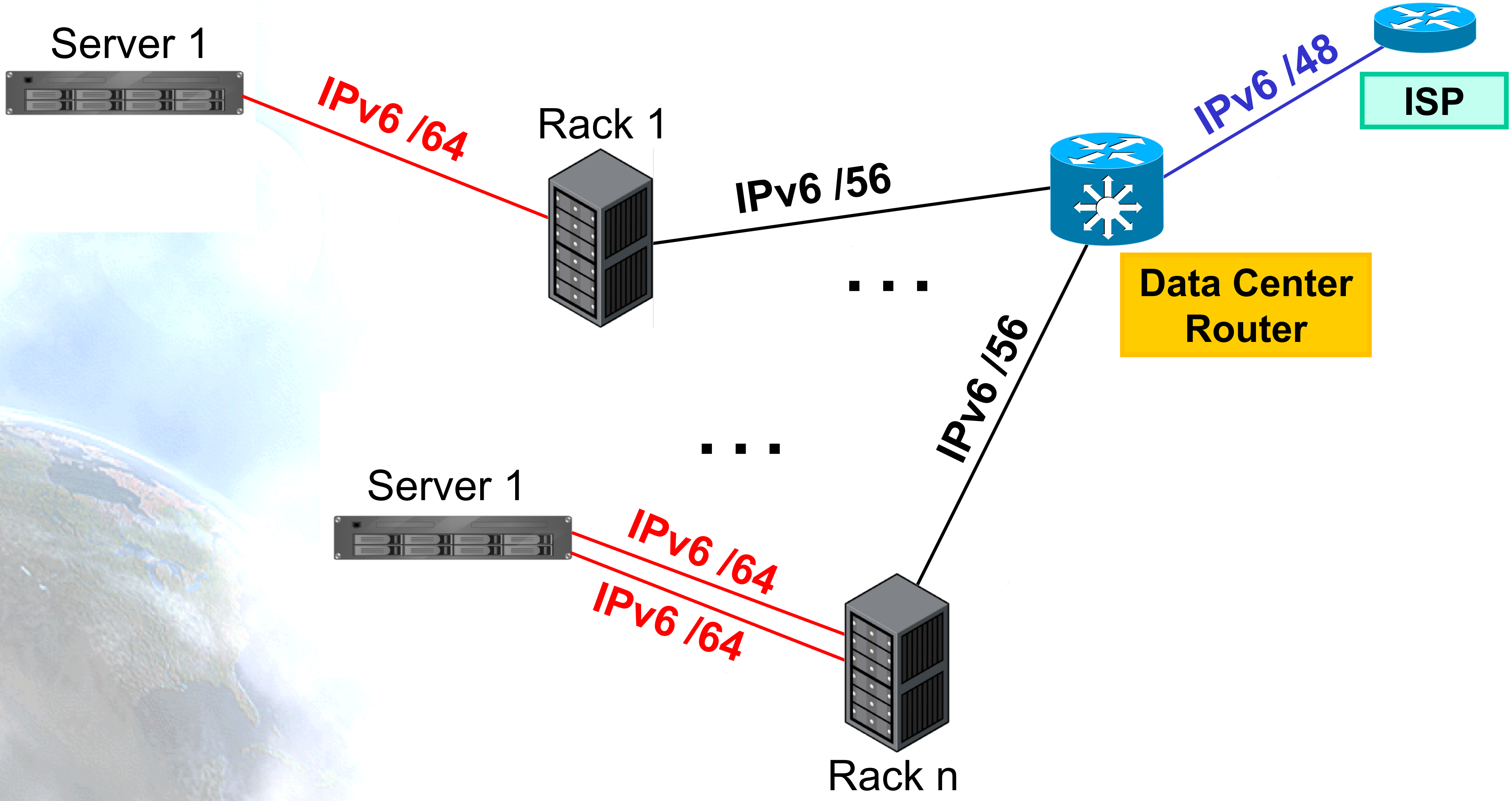
Data Center Example



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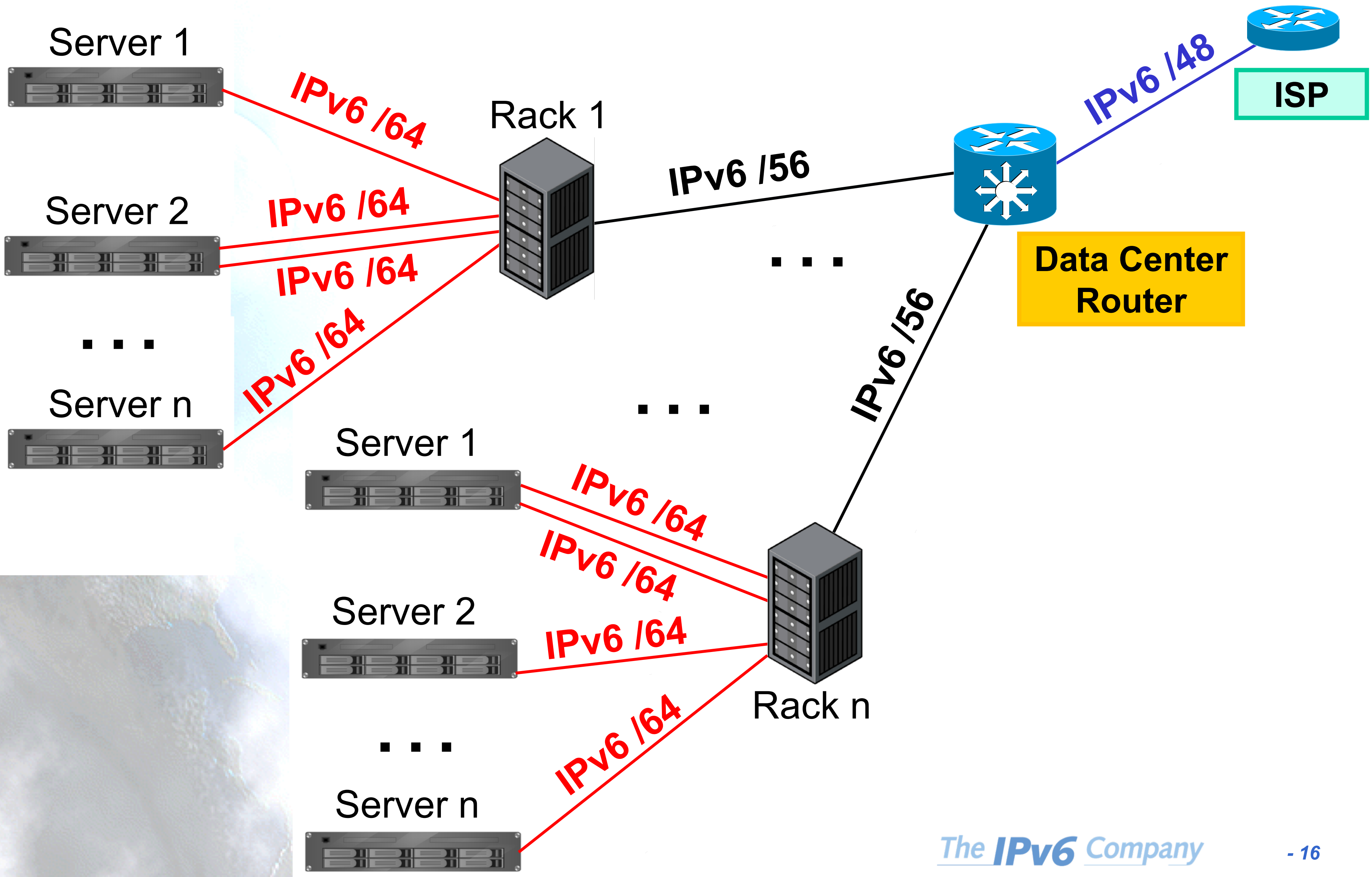
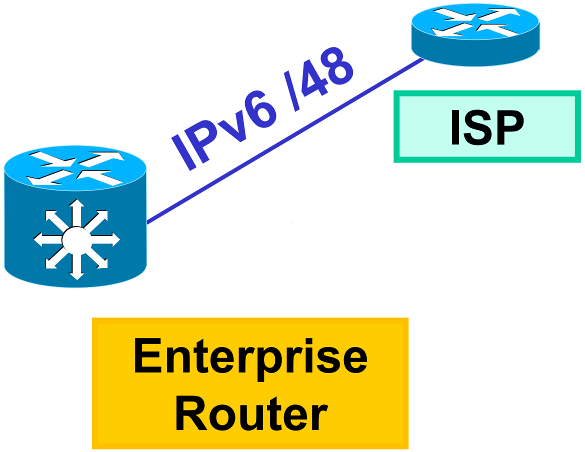


Enterprise Example



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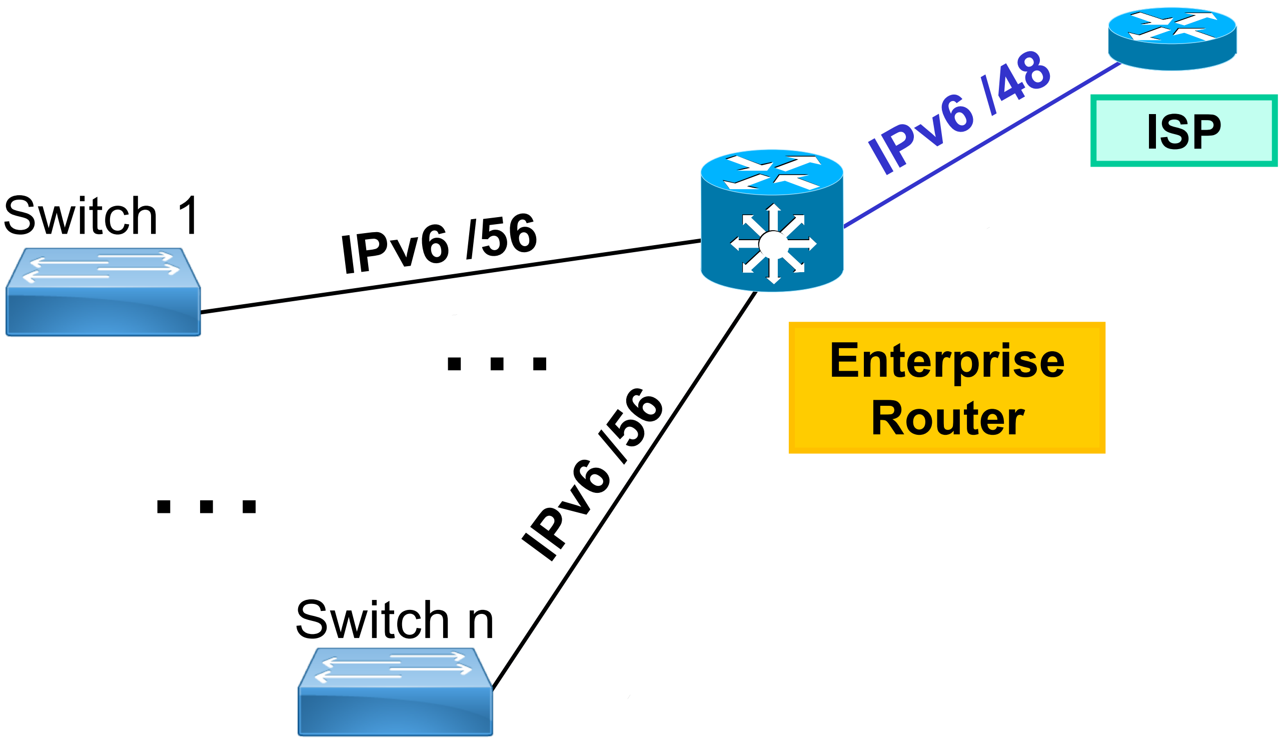

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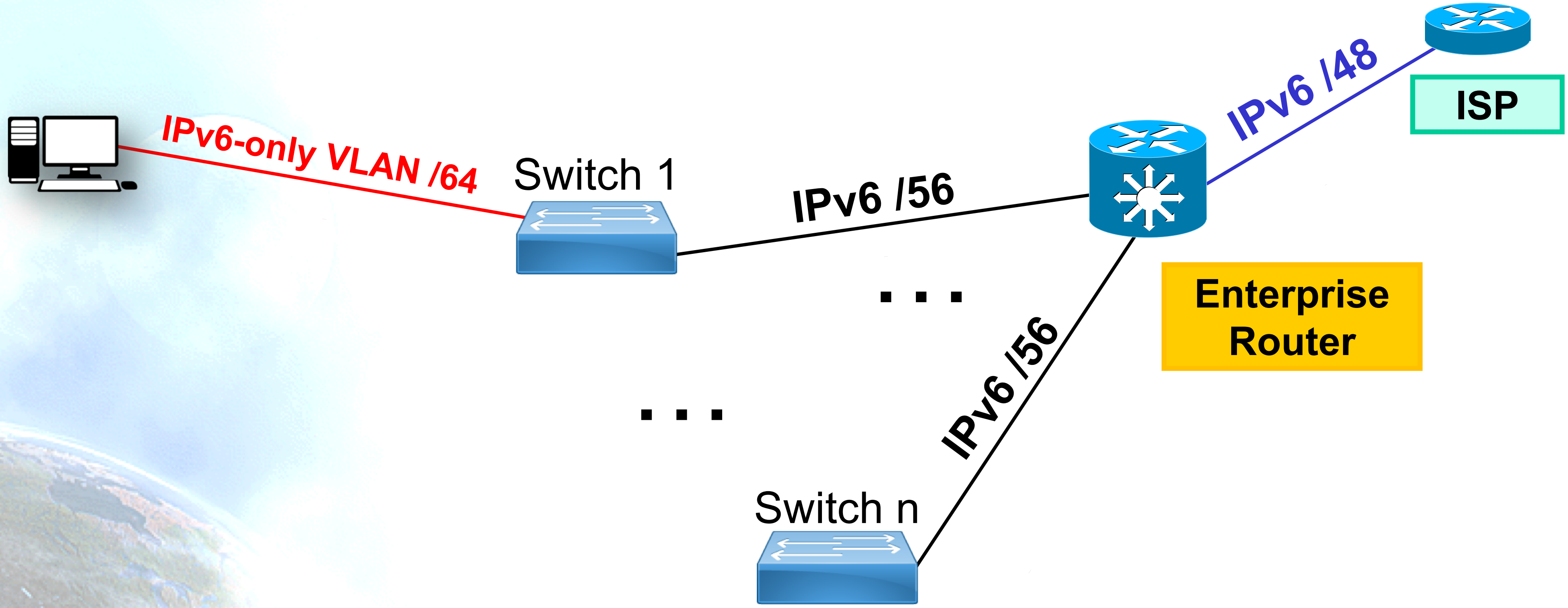

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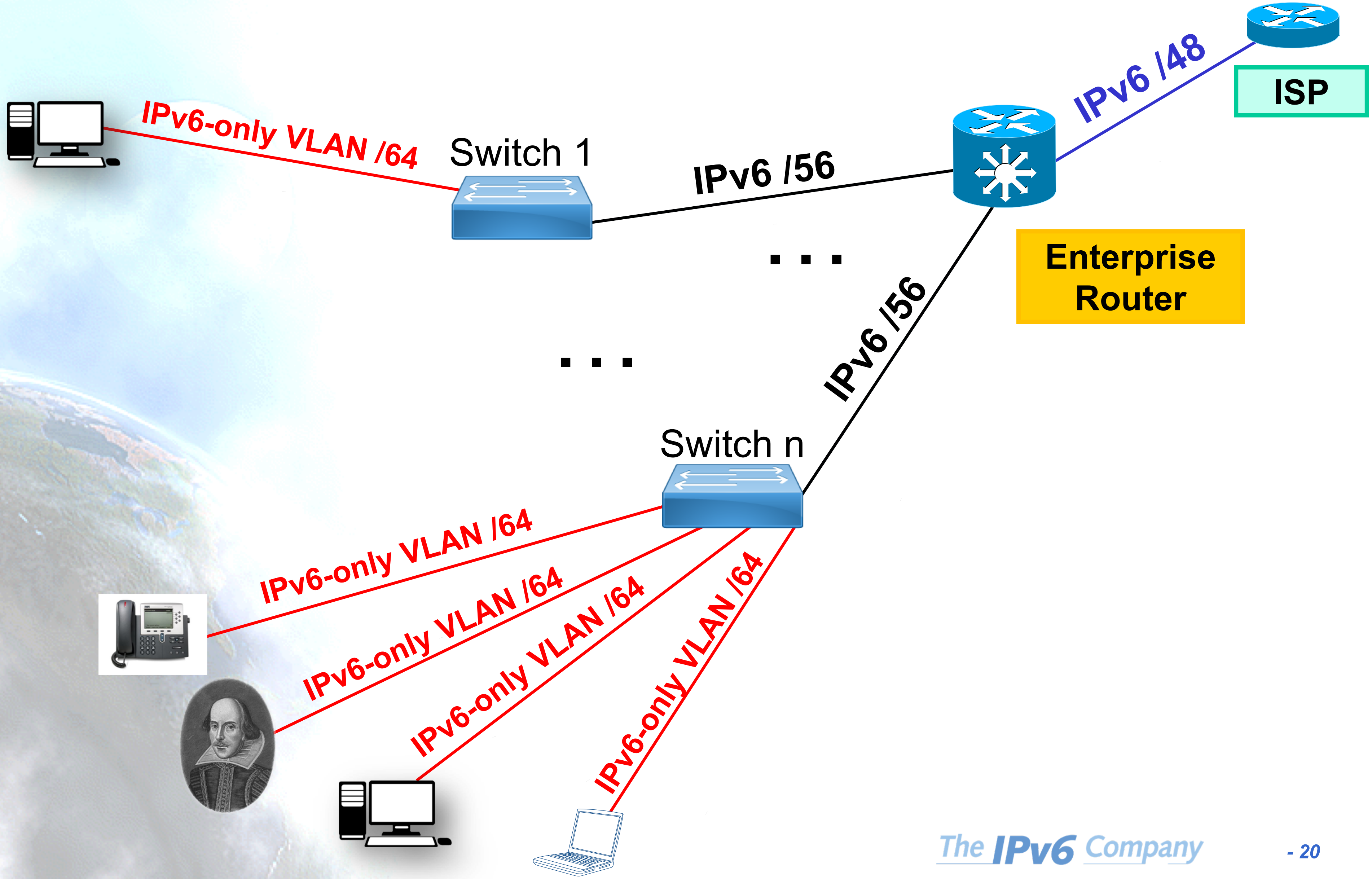

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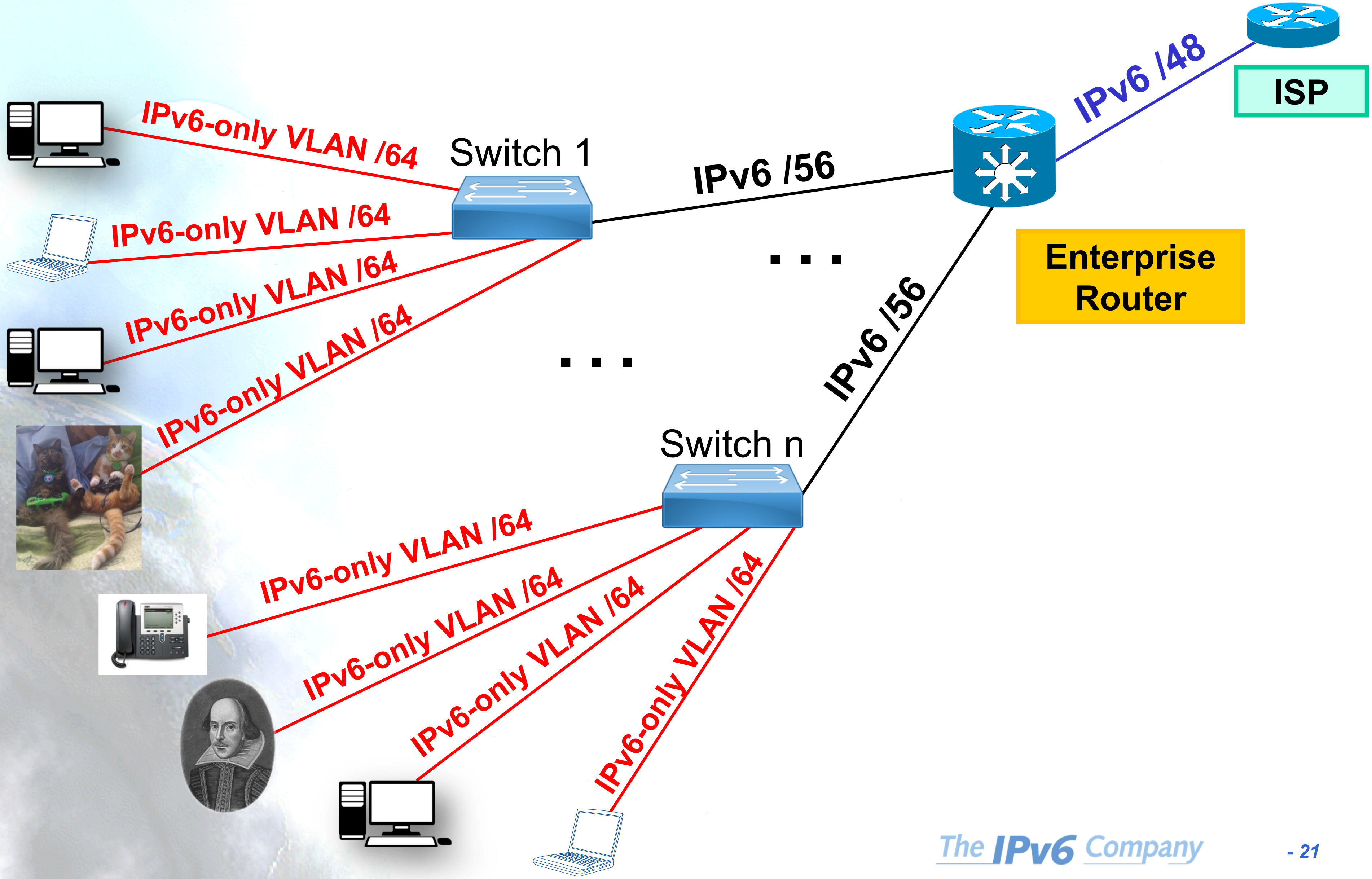

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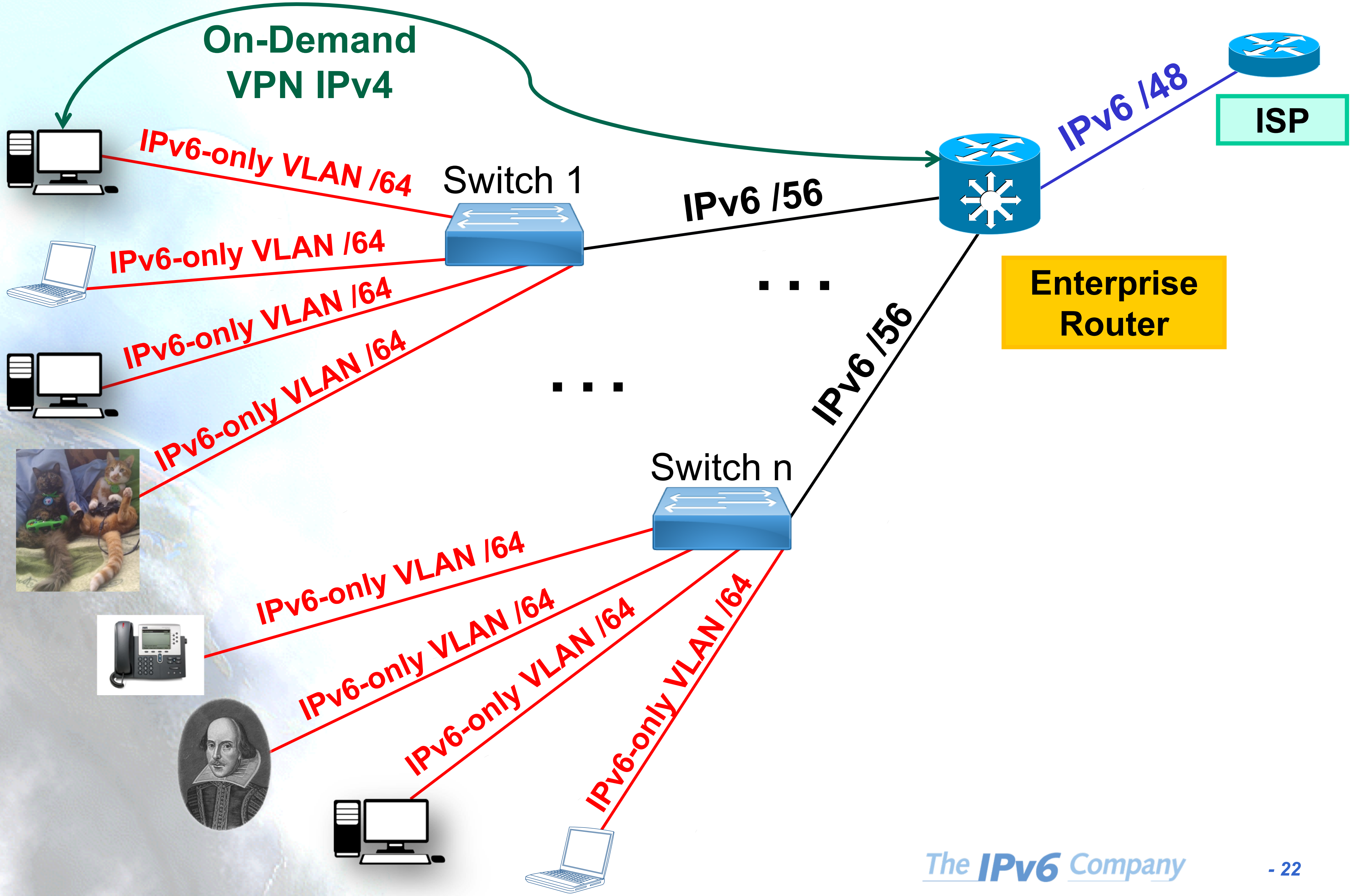

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Conclusions RFC8273

- Stable and secure IPv6-only experience

- No performance impact

- Secure host-to-host communication managed by first-hop router

- Each unique IPv6 prefix can function as a control-plane anchor point to ensure that each device receives expected subscriber policy and service levels
  - Throughput
  - QoS
  - Security
  - Parental control
  - Other value-added-services …

Thanks!

Contact:

- Jordi Palet: jordi.palet@theipv6company.com