

Raiders of the lost Ark

(read: “in search for the lost CE”)

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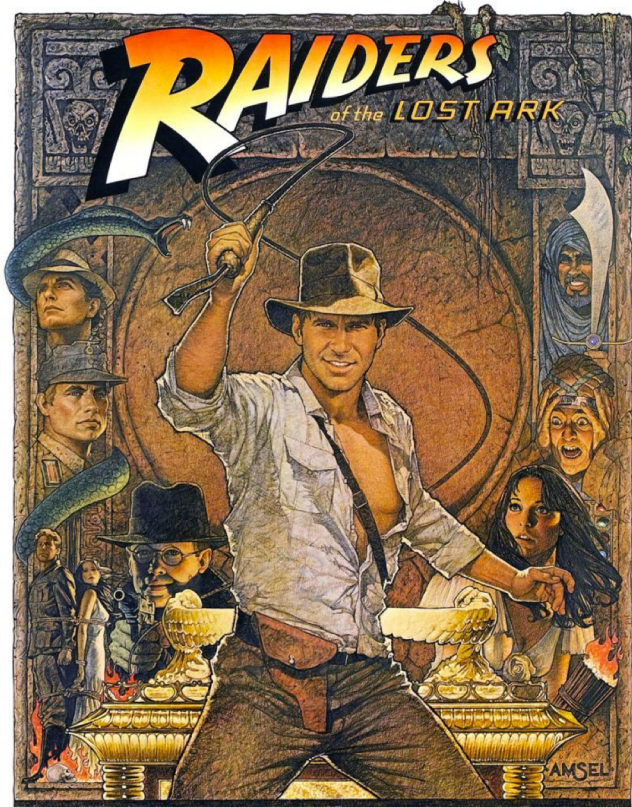


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Just like Indiana Jones ...

The Return of the Great Adventure.



- One of the difficulties to get IPv6 deployed has been the lack of CEs with good IPv6 support
 - Dual-stack
 - Transition mechanisms
- RFC6204 (2011), obsoleted by RFC7084 (2013), helped
 - “Basic Requirements for IPv6 Customer Edge Routers”
 - Only partially
 - transition was not key
- Meant for a world that can deploy dual-stack or IPv6-in-IPv4 (6rd, others)

PARAMOUNT PICTURES Presents A LUCASFILM LTD Production
A STEVEN SPIELBERG Film

Starring HARRISON FORD

KAREN ALLEN PAUL FREEMAN RONALD LACEY JOHN PHYSIS-DANES DENHOLM ELLIOTT

Music by JOHN WILLIAMS Costumes by GEORGE LUCAS Hair by HOWARD KAZANIAN Special Effects by LAWRENCE KASDAN Story by GEORGE LUCAS and PHILIP KAUFMAN

Produced by FRANK MARSHALL Directed by STEVEN SPIELBERG Edited by ...

PG PARENTAL STRONG CAUTION SUGGESTED FOR CHILDREN UNDER 13 YEARS OF AGE MAY NOT BE APPLICABLE FOR ALL SHOWINGS

A PARAMOUNT PICTURE

The fight of the smaller

- Big ISPs are able to customize the CEs to their own needs ...
 - Tell me what you want!
- Small and medium ISPs can't buy big quantities
 - Need to buy in the retail market
 - You get what is there
 - no special features, not all the needed RFCs/protocols
 - Different models/vendors = different features = more complex O&M



- Lack of pressure to CE vendors
 - Lack of required features

Surprise ... no more IPv4

- We run out of IPv4 ...
- Dual-stack and IPv6-in-IPv4 (6rd, others) are no longer an option !
 - CGN is not an option
 - Expensive boxes
 - Your IP ranges in the CGN will get soon black listed
 - You recycle them
 - You need to invest again in acquiring new IPv4 blocks ...



We are tied ...

- IETF to the rescue!
- Can we survive in an IPv6-only world ?
 - New transition mechanisms allow
 - IPv6-only access networks
 - IPv4-as-a-Service (IPv4aaS)



Wait a minute ... not yet done!

- The CEs need to support that ...
- Small ISPs will not get it that easy
- Need to update RFC7084



My journey started in 2016

- RFC7084-bis adopted by v6ops (Chicago, March 2017)
- Push-back in July 2017 (Prague)
 - Discussed several options (4 new I-Ds)
- New ID, not related to RFC7084, in Singapore (Nov. 2017)
 - Adopted as WG item in March 2018 (London)
- 8 new versions later ... Last call in August 2018!



The IPv6 CE with IPv4aaS

- Specifies the IPv4 service continuity requirements for an IPv6 Customer Edge (CE) router, either provided by:
 - the service provider
 - retail market
- Provisioning of IPv6 transition services for the support of "IPv4 as-a-Service" (IPv4aaS) by means of new transition mechanisms



- Required in a world where IPv4 addresses are no longer available, so hosts in the customer LANs with IPv4-only or IPv6-only applications or devices, requiring to communicate with IPv4-only services at the Internet, are still able to do so

draft-ietf-v6ops-transition-ipv4aas

- Specifies the IPv4 service continuity mechanisms to be supported by an IPv6 Transition CE Router, and relevant provisioning or configuration information differences from [RFC7084]
- NOT a recommendation for service providers to use any specific transition mechanism
- Automatic provisioning of more complex topology than a single router with multiple LAN interfaces may be handled by means of HNCP [RFC7788]
- An ISP MAY specify a different set of features

If you're a Vendor

- Since it is impossible to know prior to sale which transition mechanism a device will need over its lifetime, the IPv6 Transition CE Router intended for the retail market MUST support all of them



IPv4aaS Transition Requirements

- Key target: Support of IPv6-only WAN access and legacy IPv4 functionality
 - IPv4-only devices or apps in customer LANs
1. MUST support the DHCPv6 S46 priority options [RFC8026] (Unified IPv4-in-IPv6 Software Customer Premises Equipment (CPE): A DHCPv6-Based Prioritization Mechanism)
 2. MUST have a GUI, CLI and/or APIs
 3. MUST request transition config options and keep them disabled
 4. MUST check for a valid priority match to enable them
 5. If no match, keep all them disabled
 6. MUST allow appropriate subnetting if more than one LAN

Transition Mechanisms

- 464XLAT
- DS-Lite
- Iw4o6
- MAP-E
- MAP-T

464XLAT Requirements

1. MUST perform IPv4 NAT unless a dedicated /64 is available for the stateless NAT46 translation
2. SHOULD support IGD-PCP IWF [RFC6970] (UPnP Internet Gateway Device - Port Control Protocol Interworking Function)
3. If PCP [RFC6887] is implemented, MUST also implement [RFC7291] (DHCP Options for the PCP)
4. MUST implement [RFC7050] (Discovery of the IPv6 Prefix Used for IPv6 Address Synthesis)
5. If PCP is implemented, MUST follow [RFC7225] (Discovering NAT64 IPv6 Prefixes Using the PCP)
6. [RFC8115] MUST to discover a valid NAT64 prefix
7. Implements a priority for the NAT64 prefix
8. A valid NAT64 means 464XLAT is prioritized following [RFC8026]

DS-Lite Requirements

1. MUST support configuration with DHCPv6 [RFC6334]
2. SHOULD support IGD-PCP IWF [RFC6970]
3. If PCP [RFC6887] is implemented, MUST also implement [RFC7291]
4. MUST NOT perform IPv4 Network Address Translation (NAT)

Iw4o6 Requirements

1. MUST support configuration of Iw4o6 via the Iw4o6 DHCPv6 options [RFC7598] (DHCPv6 Options for Configuration of Software Address and Port-Mapped Clients)
2. MUST support the DHCPv4-over-DHCPv6 (DHCP 4o6) transport [RFC7341] (DHCPv4-over-DHCPv6 Transport)

MAP-E Requirements

1. MUST support configuration of MAP-E via the MAP-E DHCPv6 options [RFC7598]
2. MAY support Dynamic Allocation of Shared IPv4 Addresses [RFC7618] (Dynamic Allocation of Shared IPv4 Addresses)

MAP-T Requirements

1. MUST support configuration of MAP-T via the MAP-T DHCPv6 options [RFC7598]
2. MAY support Dynamic Allocation of Shared IPv4 Addresses [RFC7618]

Other Requirements

1. If IPv4 multicast services are supported, then it MUST support [RFC8114] (Delivery of IPv4 Multicast Services to IPv4 Clients over an IPv6 Multicast Network) and [RFC8115] (DHCPv6 Option for IPv4-Embedded Multicast and Unicast IPv6 Prefixes)
2. UPnP support related
3. 6rd no longer supported (vendors may keep it)

Code Considerations

- Adding support in existing CEs for those transitions mechanisms, requires around 10-12 Kbytes
 - Most of the code base is shared among several transition mechanisms
 - Single data plane is common
- Typically means about 0,15% of the existing code size in popular CEs already in the market
- New requirements don't have extra cost in terms hardware (RAM, CPUs, etc.)
- Example: OpenWRT

Conclusions

- Indiana Jones was looking for the “lost ark”
 - We finally found the “lost CE” for an IPv6-only Internet
- If you’re an ISP, make sure too look for this (soon RFC) in your new CE acquisitions:
 - draft-ietf-v6ops-transition-ipv4aas
 - Will make your life easier and reduce you O&M costs



- If you’re a vendor, you will have many more business opportunities complying with it
 - Simplify your manufacturing process, less firmware versions, all them work for any ISP, same as for the retail market
 - Reduce R&D costs!

Thanks!

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