



FRANCE IPv6 Taskforce

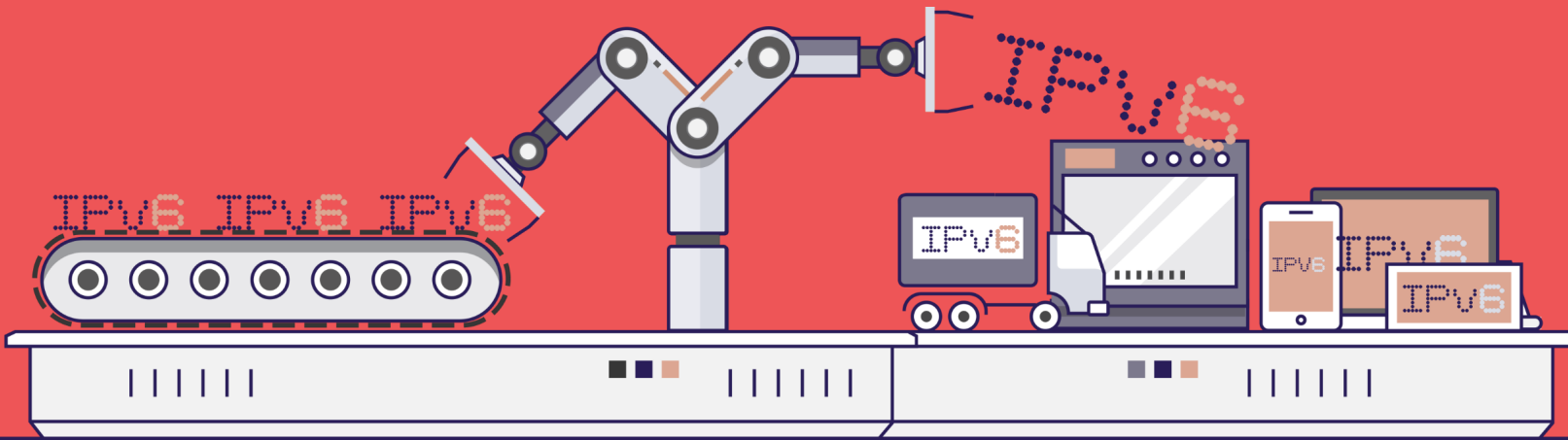


IPv6 taskforce FR

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Stockholm
Feb 1st 2023

*Member, FRANCE IPv6 Taskforce
(by ARCEP and ISOC FR)*



What will I address

::A: ARCEP yearly IPv6 Barometer

::B: Handbook

::C: Carrier's choices

::D: An address and then ?

::E: What's next for IPv6?



::A: ARCEP Annual IPv6 BAROMETER

- Collect KPIs & forecasts
- Fine & granular report
 - Public VS Pro Customers
 - xDSL, Cable, FttH, mobile
 - Android, iPhone, (Both for Data and Tethering/hotspot)
 - Available VS enabled by default
 - IPv4 address sharing policy
 - Top domain AAAA and MX, IPv6 DNS server
- New questions in the upcoming release



Some ISP KPIs

From 2021 report

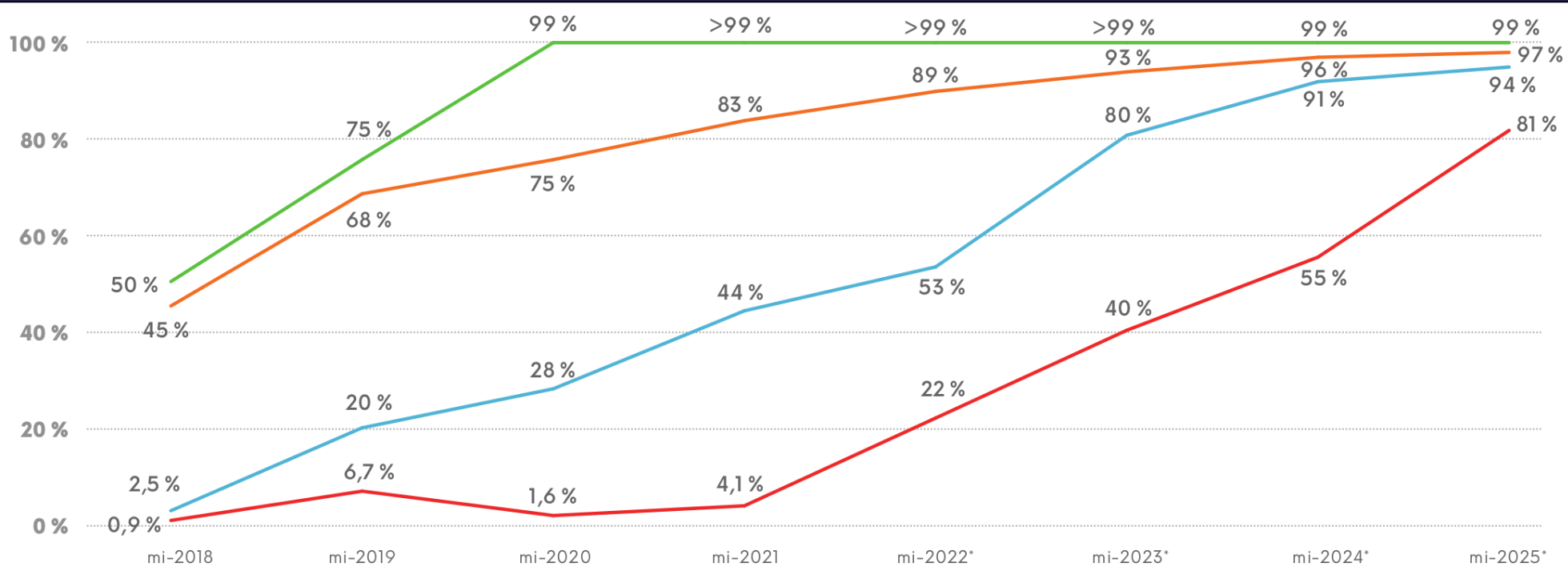
MOBILE NETWORK: PERCENTAGE OF IPv6-READY AND IPv6-ENABLED CUSTOMERS EVOLUTION

		bouygues TELECOM		free		orange		SFR	
		IPv6-ready	IPv6-enabled	IPv6-ready	IPv6-enabled	IPv6-ready	IPv6-enabled	IPv6-ready	IPv6-enabled
Android	Mid-2019	100%	79%	0%	0%	100%	3%	0%	0%
	Mid-2020	100%	87%	0%	0%	100%	35%	2%	0.2%
	Mid-2021	100%	87%	100%	1%	100%	47%	100%	13%
	Mid-2022*	100%	85-95%	100%	not provided	100%	50-60%	100%	25-35%
	Mid-2023*	100%	85-95%	100%	not provided	100%	60-70%	100%	40-50%
	Mid-2024*	100%	85-95%	100%	not provided	100%	65-75%	100%	60-70%
Android tethering	Mid-2019	100%	79%	0%	0%	0%	0%	0%	0%
	Mid-2020	100%	87%	0%	0%	100%	15%	2%	0.2%
	Mid-2021	100%	87%	100%	1%	100%	35%	100%	13%
	Mid-2022*	100%	85-95%	100%	not provided	100%	40-50%	100%	25-35%
	Mid-2023*	100%	85-95%	100%	not provided	100%	50-60%	100%	40-50%
	Mid-2024*	100%	85-95%	100%	not provided	100%	60-70%	100%	60-70%



Some ISP KPIs

From upcoming report

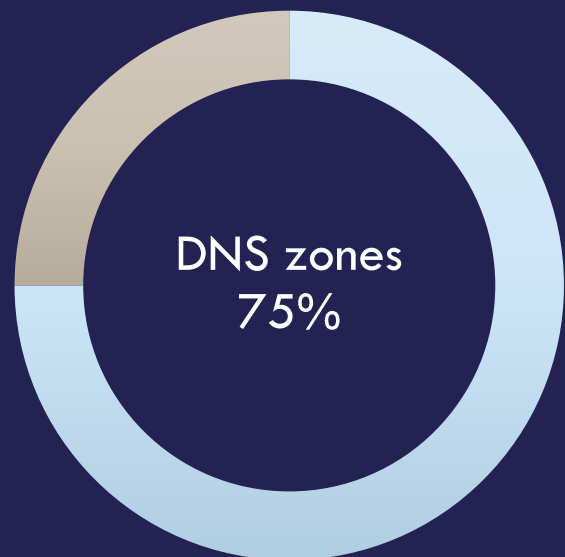


BROADBAND :
% of IPv6 enabled customers (2018-2025 forecast)

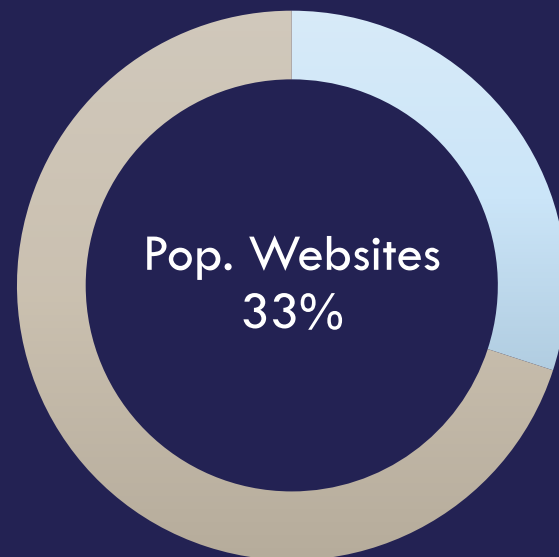
BROADBAND :
% of IPv6 ready and enabled customers (mid 2022)

		bouygues TELECOM		free		orange		SFR	
		IPv6-ready	IPv6 activé	IPv6-ready	IPv6 activé	IPv6-ready	IPv6 activé	IPv6-ready	IPv6 activé
xDSL	Own network	70 %	70 %	100 %	100 %	82 %	80 %	100 %	1 %
	3 rd party backhaul	0 %	0 %	0 %	0 %	non concerné		0 %	0 %
Câble		non concerné		non concerné		non concerné		0 %	0 %
FttH		60 %	60 %	100 %	100 %	100 %	98 %	70 %	50 %
4G/5G Fixe			32 %		0 %		0 %		33 %
Intégralité du réseau		53 %	53 %	99 %	99 %	91 %	89 %	61 %	22 %

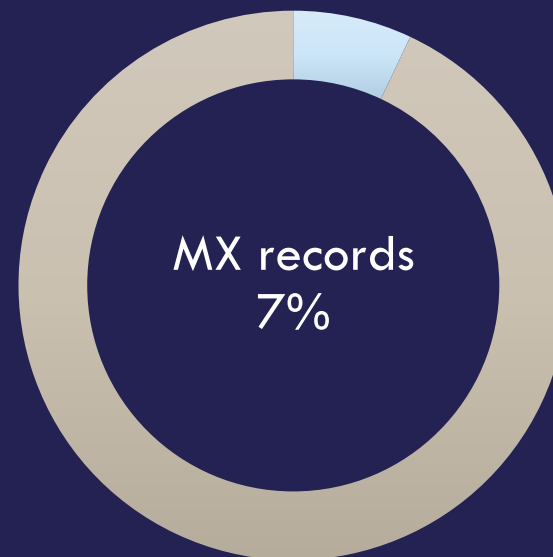
Some web KPIs (.fr, .re...)



■ Dual-Stack ■ IPv4



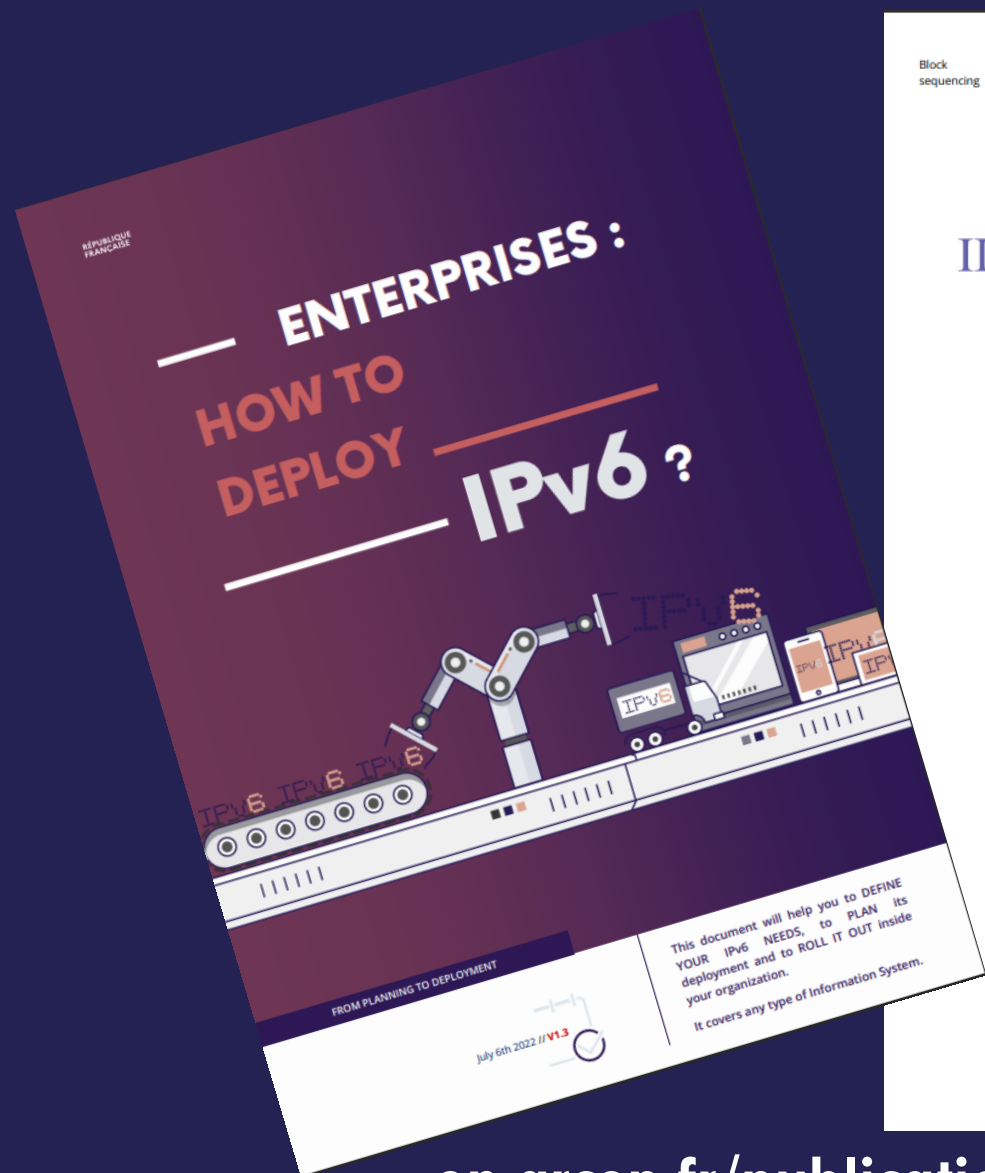
■ Dual-Stack ■ IPv4



■ Dual-Stack ■ IPv4



::B: Handbook (124 pages)



Block sequencing

III. Block sequencing

IPv6 deployment is logically to be done starting with the bottom, the network layer. And before any deployment it is coherent to prototype the behavior of each component. Very few organizations have an end-to-end lab and qualification environment, both horizontally within the same layer and vertically between layers. For example, your campus, datacenter and security network prototypes may be managed by different teams and are not interconnected in a topology close to the production one, this is a horizontal break. If a qualification server is running on a network with production routers, we have a vertical break. This makes sense, otherwise how can you debug a problem if all the stack layers are in test, it would look like a multi-level rola-bola.

We will retain that each layer has its own test environments, and that those run on lower layers' production environments. In short, every qualification runs itself on an underlying production environment (except for the foundation that is network). This can be represented as follows:

1. Warm up

Before you even decide where to begin, start by making sure that all of your current and future specifications / RFPs / subcontractors requests include IPv6 compatibility and guarantee its proper functioning. These processes often take a long time to change, so it is advisable to start working on them right away.

This also includes build, run, life cycle processes and everything related to them.

IPv6 Transition Guide | 40

Grasp of the subject

fleets than to migrate to IPv6. In real life, don't try it, except in the lab out of pure curiosity. Google' GCP allows to use it on VPC but mention possible OS problems: <https://cloud.google.com/vpc/docs/vpc-invalid-ips>. Nevertheless they don't specify you might even be unable to learn such prefixes on your on premises BGP routers, although at least 2 vendors support this space via a command.

The use of one of the "cheat" scenarios described above to extend private addressing or the short horizon of reaching the end of the RFC 1918 pool appearing to be near (less than a few years at your consumption rate) should prompt you to give serious consideration to an IPv6 deployment.

Remember the time spent on past and future NAT44 and re-addressing projects related to the incorporation of newly acquired entities. Have you ever seen an IT department decide that they would start their internal addressing with the 10.255.0.0/16 block in the downstream direction because their company would be acquired one day and hopefully the new parent entity would have started their addressing with 10.0.0.0? More seriously, IP addressing conflicts during structure integration generate costs and delays that are often significant, in addition to added complexity for long-term operation in the event that NAT44 remains in place.

In this example of mobile connection sharing, IPv6 traffic is simply tracked by the destination firewall. IPv6 traffic is altered 3 times!

QR code

What's in ?

Double Stack or lighter :FOOD: ?

- Help to know who you need and when
- Choose your path according to your needs
 - Scope, mechanism, process
 - Hiking through layers, in the right order
- Include many advices and best practices
 - Topology
 - Addressing
 - Security



Internal DC



- Servers
- VMs
- Containers
- Infra Services
- FW, IPS, SLB,...

DC
access
& Core
NET

BACK
HAUL

B
A
C
K
B
O
N
E

Campus



- Local Services
- LAN, Wi-Fi
- FW

Campus
NET

Where to
Deploy ?

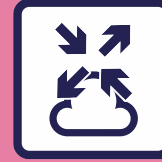
Some edges may be connected to internal DC with a shorter path, Campus may have local breakout internet, possibilities are endless...

Where do you need IPv6?

EDGE

NETW
ORKS

Partner InterConnect

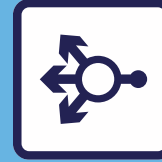


- Internet (IPsec, TLS,...)
- Private lines



Cloud

Remote Workers

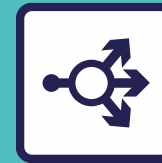


- VPN Gateways
- MDM
- Reverse proxies
- FW



Home
Office

Visible resources

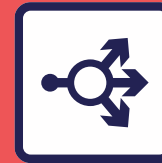


- Reverse proxies
- Front ends
- SLB
- DNS, MX
- FW



Client

Common internet access



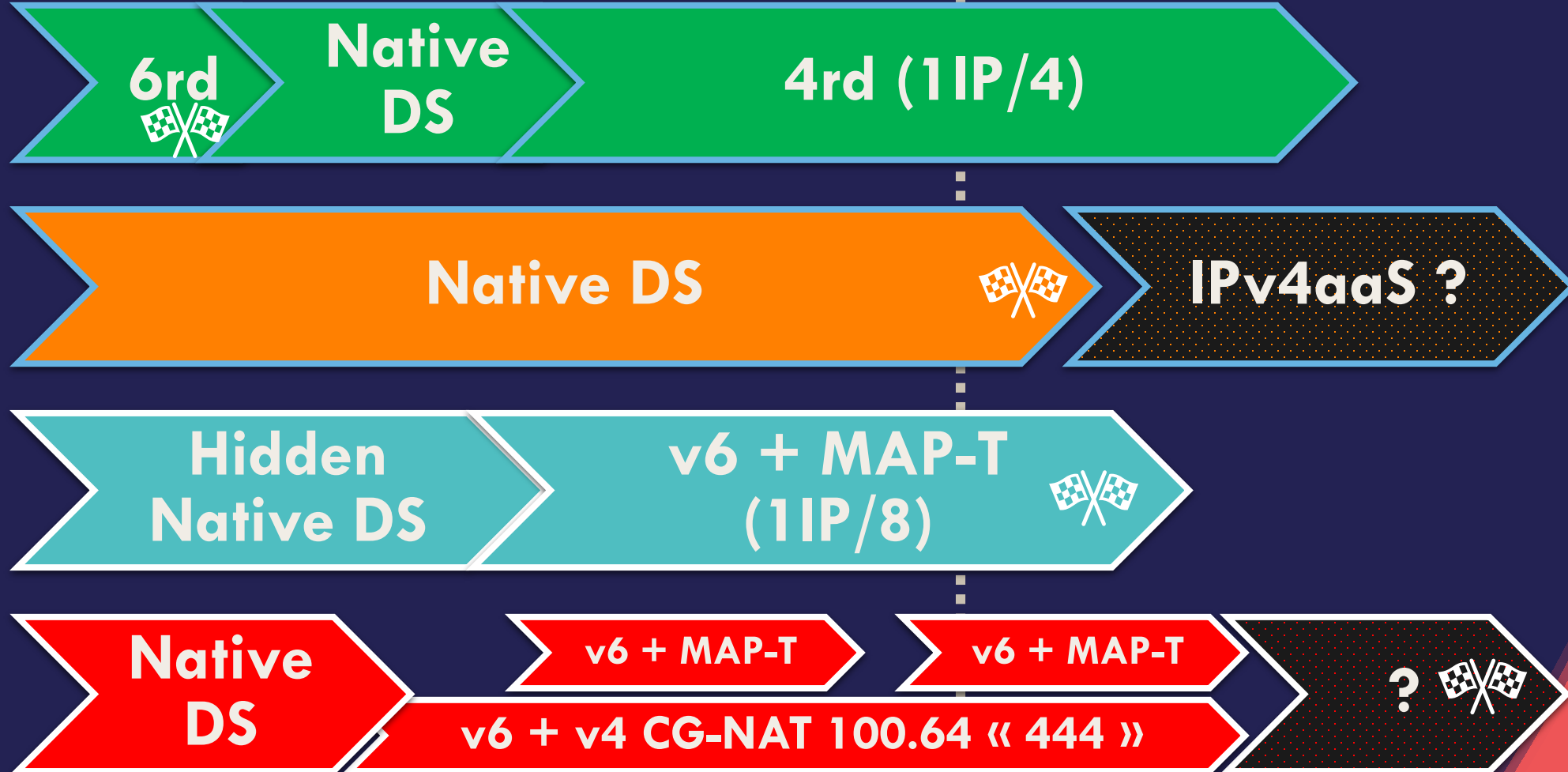
- Proxies
- SMTP, DNS
- FW



Various

::C:1: Broadband

Today



::C:1: Broadband

- Provide v6 today with 6rd if you can get Border Routers.
 - v6 traffic in volume can hit 90% for public !
 - BR can run on x86 hardware @100Gb/s with DPDK
- Once got v6, Use Stateless IPv4 sharing A+P (MAP, lw4o6)
 - Enable multipoint traffic
 - Settings provided by DHCP to CPE
- Take care of MTU (e.g MAP-T \approx 1520 Bytes, + 6vPE MPLS...)
- Watch for CPE performance (CPU translation + FttH/B bandwidth...)
- Forecast IPTV, VoIP and other internal services



::C:2: Mobile

- ARCEP 5G radio frequency bid required IPv6 !
 - Missed to require it by default on new phones
- 3 carriers doing NAT64 + DNS64 with WKP 64:ff9b::/96
- 1 have NAT64 with ISP prefix and no DNS64
 - Requires phone APN set-up! Only for Android!



::C:3: Tethering / hotspot

- NAT64 is intended for unmanaged devices AWARE OF IT !
 - Android (464 CLAT) and iPhone (Direct remap)
 - Most ISP are sadly providing DNS64 answers for tethering too
 - Might be incompatible with some softwares (while they don't specify A record)
 - Stateful NAT64 load on core (PLAT)
 - less SoC load as phone 464CLAT is rarely used (but now HW offloaded anyway)
 - Provide DNS64 only to phone, not to hotspot clients
 - No chance of customer problem
 - Stateful NAT64 on core (PLAT) + 464CLAT on phone (Stateless if dedicated /64)



::C:3: Tethering / hotspot

- NAT64 Awareness ?

```
PS C:\Users\jc> Resolve-DnsName -Name ipv4only.arpa
```

Name	Type	TTL	Section	IPAddress
ipv4only.arpa	AAAA	21600	Answer	64:ff9b::c000:aa
ipv4only.arpa	AAAA	21600	Answer	64:ff9b::c000:ab
ipv4only.arpa	A	19188	Answer	192.0.0.170
ipv4only.arpa	A	19188	Answer	192.0.0.171

- Move on when modern PC OSes become NAT64 aware (PCP, ipv4only.arpa, Pref64 RA option) + DHCP option 108
 - macOS now has a complete CLAT engine and is ready for IPv6 only networks, while Windows only support it on 4/5G modem






::D: An ADDRESS and then ?

- Let people use all of IPv6
 - Router cascading with DHCPv6-PD, flash renumbering and many more
 - Port dynamic (PCP) and manual opening (tracking ND changes)
- Today, some consumer products softwares/games are still requesting you to disable IPv6!
- IPv4 SLA will decrease compared to IPv6 owing to transition mechanisms.



New barometer questions

Technologies			<i>free</i>		
% of customers with a dedicated IPv4	xDSL Own network	94 %	25 %	100 %	100 %
	xDSL 3 rd party back	100 %	0 %	non concerné	100 %
	câble	non concerné	non concerné	non concerné	100 %
	FttH	99 %	15 %	100 %	50 %
	4G/5G Fixe	100 %	0 %	0 %	100 %
Availability of dedicated option if shared	xDSL, câble, FttH	Option gratuite	Option gratuite	IPv4 dédiée par défaut	IPv4 dédiée non proposée
	4G/5G Fixe	IPv4 dédiée par défaut	IPv4 dédiée non proposée	IPv4 dédiée non proposée	IPv4 dédiée par défaut
Lifetime of IPv4 (except backhaul or access layer changes)	xDSL, câble	Fixe	Fixe	Dynamique	Dynamique
	FttH	Fixe	Fixe	Changement en cas de déconnexion de la box > 7 jours	"Fixe (lorsque dédiée)"
	4G/5G Fixe	Dynamique	Dynamique	Dynamique	Dynamique

*From upcoming report

New barometer questions

IPv6 enabled by default for new customers	xDSL	Oui si zone activée réseau, non sinon	Oui	Oui	Non
	FttH		Oui	Oui	"Oui, si zone CG-Nat"
	4G/5G Fixe	Oui	Pas d'IPv6	Non	Oui
IPv6 enabled by default for compatible customers	xDSL	Oui	Oui	Oui	Non
	FttH	Oui	Oui	Oui	"Oui, si zone CG-Nat"
	4G/5G Fixe	Oui	Pas d'IPv6	Oui	Oui
IPv6 prefix lifetime (except backhaul or access layer changes)	xDSL	Fixe	Fixe	Dynamique	Fixe
	FttH	Fixe	Fixe	Dynamique	Fixe
	4G/5G Fixe	Dynamique	Pas d'IPv6	Dynamique	Dynamique
IPv6 prefix size	xDSL, FttH	60 bits	61 bits	56 bits	56 bits
	4G/5G Fixe	64 bits	Pas d'IPv6	64 bits	64 bits
Inability for customer to disable IPv6	xDSL	Oui	Oui	Non	Non
	FttH	Oui	Oui	Non	"Oui, si zone CG-Nat"
	4G/5G Fixe	Non	Pas d'IPv6	Oui	Oui
Default inbound IPv6 blocking firewall	xDSL, FttH	Oui	Non	Oui	Oui
	4G/5G Fixe	"Non à date, oui dans le futur"	Pas d'IPv6	Oui	Oui
Firewall opening	xDSL, FttH	"Manuellement et via PCP"	Le pare-feu optionnel ne peut être configuré	"Manuellement et via PCP"	"Manuellement et via PCP"
	4G/5G Fixe	"Non à date, possible dans le futur"	Pas d'IPv6	Le pare-feu ne peut être configuré	Manuellement (pas via PCP)

*From upcoming report

::E: What's next for IPv6?

- Specialized protocols
 - Transport, routing, higher functions
 - IoT, smart home, ...
- SRv6
 - All in one collapse
 - Carriers, corps, mobiles,...
 - App awareness
 - Already in use in a few places



::FEED:BAC4:)

- Join US
- Send your ideas, new topics to cover
- Translate

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Questions ?

