Streamline The Internet

Presentation to

TWNOG 5

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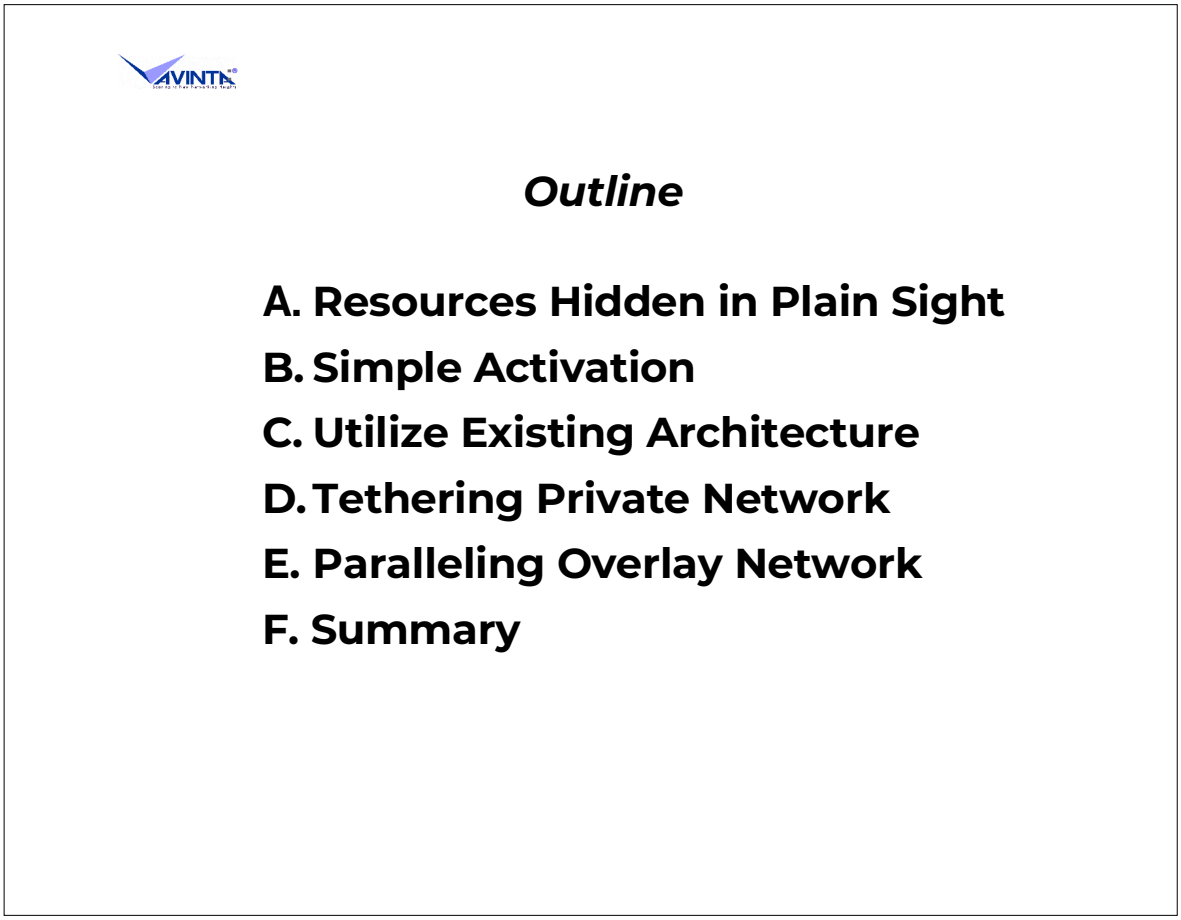
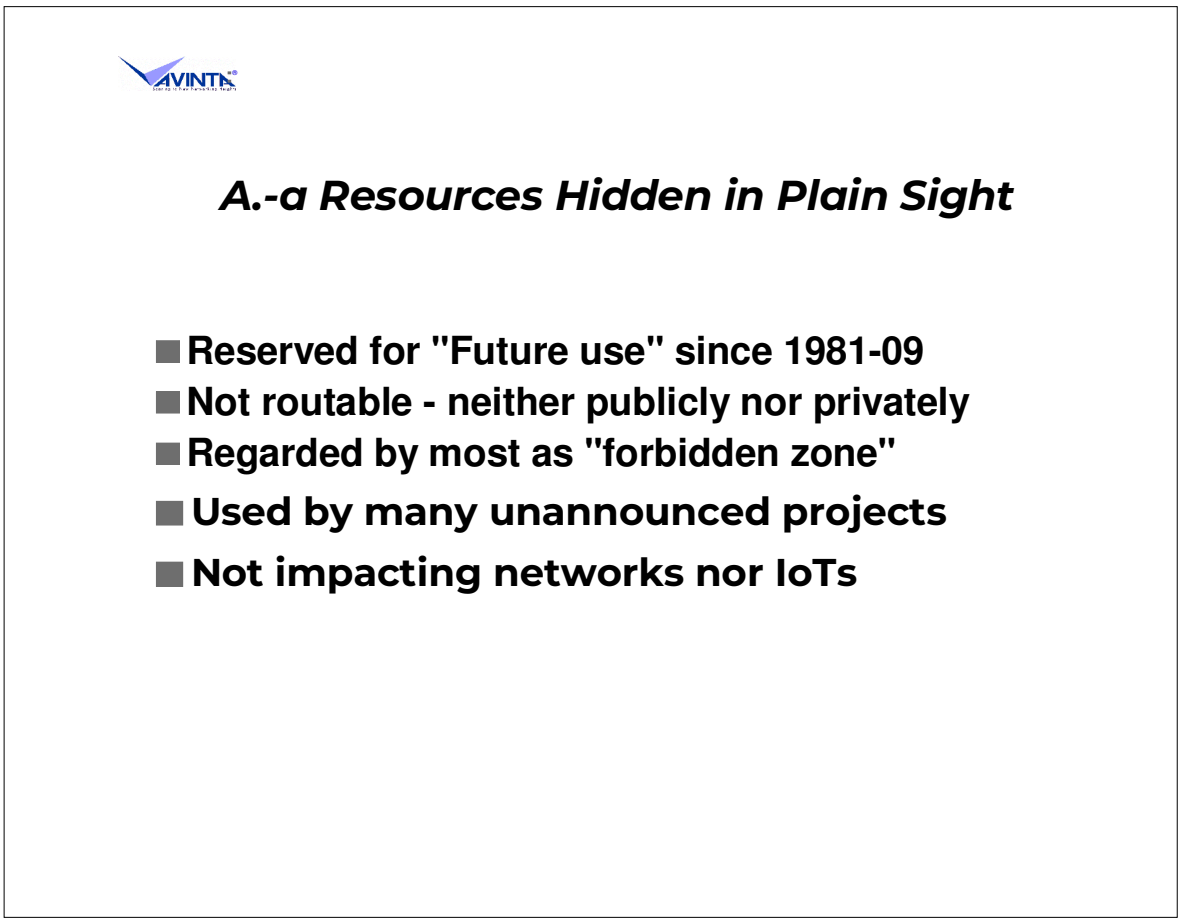
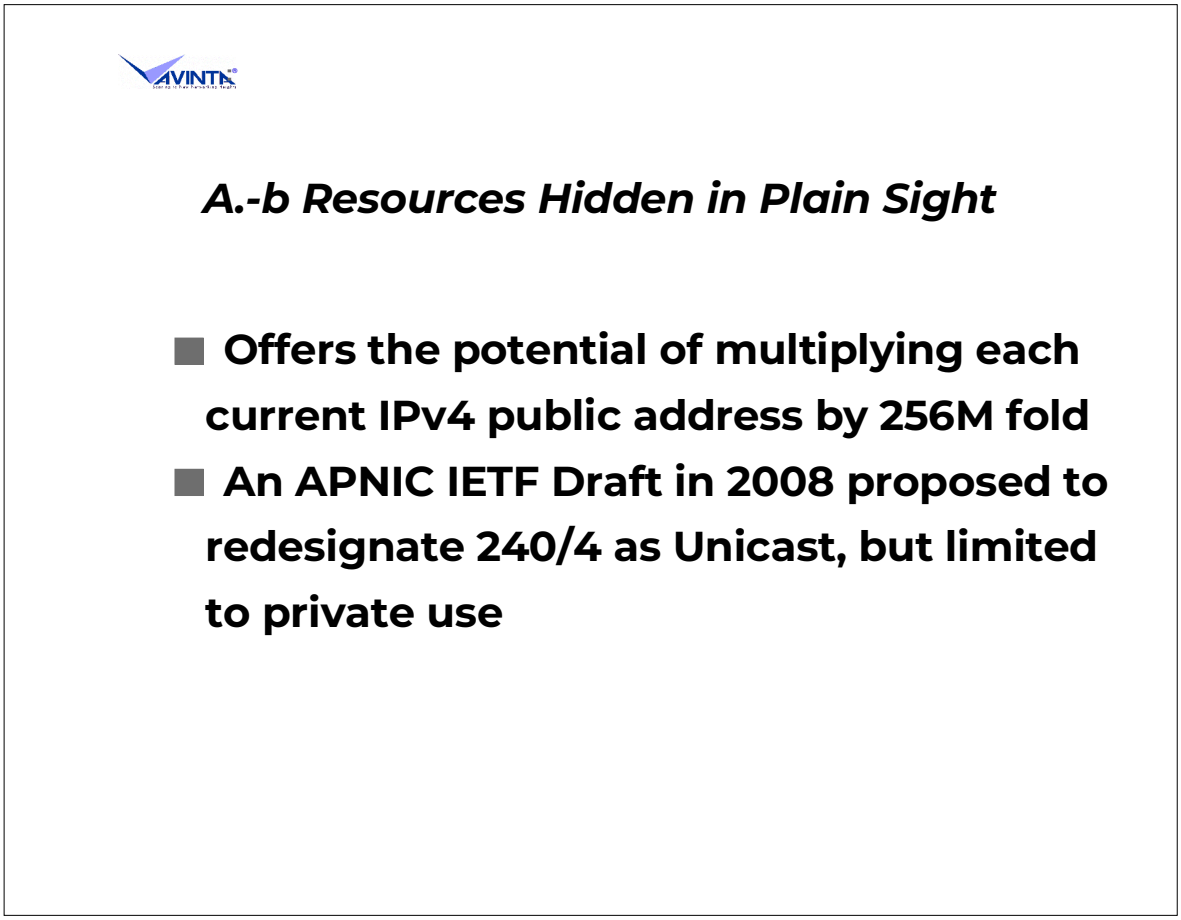
- Although the Internet achieved phenomenal advances during the last few decades, it is full of ***confusions, contradictions, or even convolutions***, depending on one's perspective.
- The Internet promotes ***leveling the playing field*** for everyone. ***US gets 4.9 IPv4 addresses per capita, while Zambia gets only 0.01***. The ratio is more than ***2.6 orders of magnitude***. Some ***other countries get no allocation, while Vatican City gets 21.4.*** - ***Is this equality? Who is playing the God?***
- The Internet promised **end-to-end connectivity**. But, its current predominate operation model is CDN ***(Content Delivery Network)*** which has ***a master-slave architecture*** that impedes such.
- The Internet took issue with ***telco monopoly and government regulation on PSTN***. Yet, we now have ***multinational conglomerates*** that each **dominates** a respective business sector to the point of ***ignoring responsibilities and evading regulations.***
- Overall, the Internet is ***vulnerable to security breaches***, ranging from harassment to ransomware.
- These days, any discussion can not avoid considering ***IPv6*** vs. IPv4. However, we will leave the former alone because its ***lengthy address format is not user-friendly*** for human use.
- A revisit of the overall environment suggests that there might be ***a fresh alternative***. It not only could ***resolve the IPv4 address shortage*** situation, but also may ***mitigate a couple related issues*** while ***offering potential new capabilities***.
- To see a whole picture, we need to look these far away from the earth, that is, ***10K miles in the space***, much more than the common wisdom of ***seeing a forest from an airplane at 30K ft***.
- Today's talk, ***"Streamline the Internet"*** will describe what a scheme called EzIP (Phonetic for Easy IPv4) may contribute to the Internet. Internally, Phoenix is the code name for our project. .



- This presentation will focus on ***high level concepts and system analyses***. With limited time, we have to save the details for future opportunities.
- **A.** **.....**
- **B.** **.....**
- **C.** **.....**
- **D.** A ***local case*** will provide a visual idea about the approach.
- **E.** A ***possible current application*** example will be presented.
- **F.** **.....**



- ***How many in the audience were born after 1981?***



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- In comparison, private netblocks under RFC1918 consists of
- 10/8 Netblock: 16M
- 172.16/12 Netblock: 1M
- 192.168/16 Netblock: 64K
- Total: 17.064M addresses
- CG-NAT:
- 100.64/10: 4M

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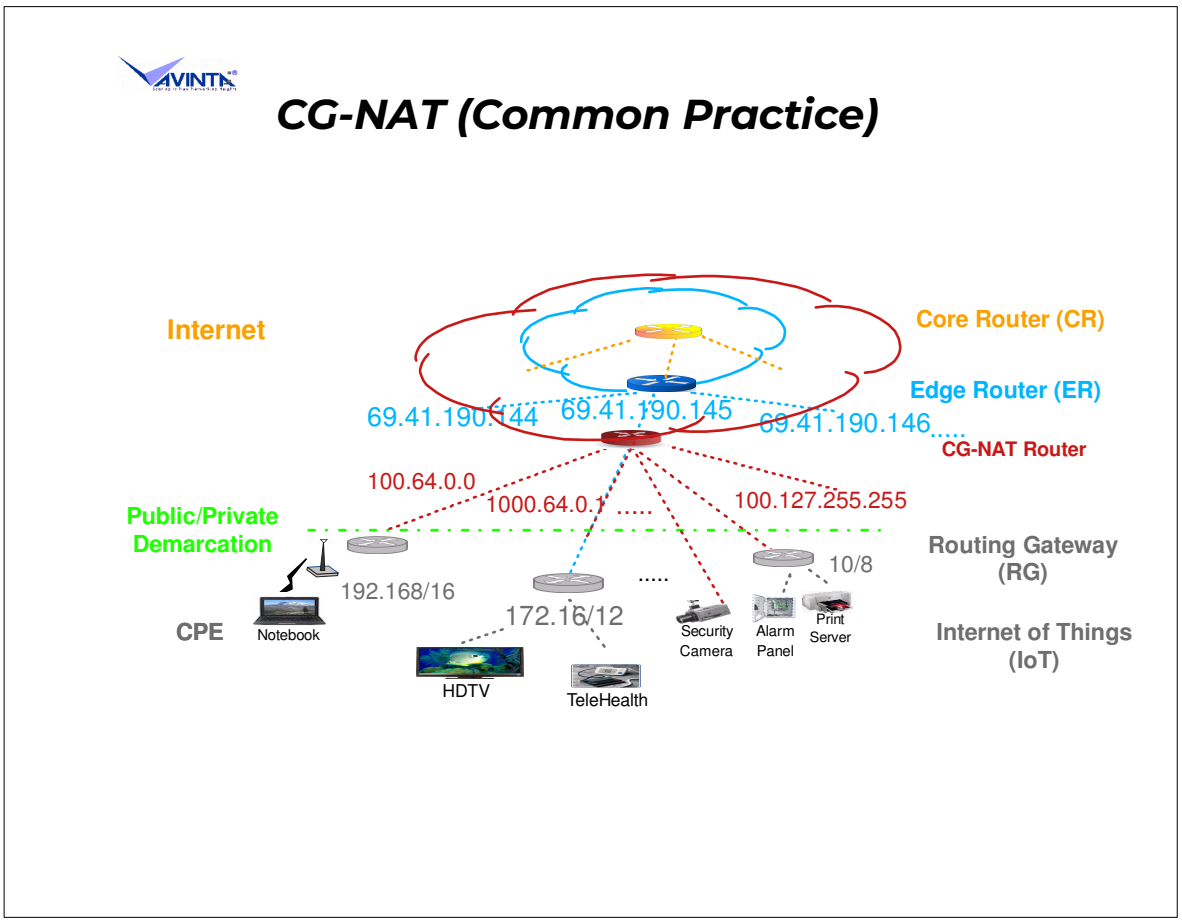
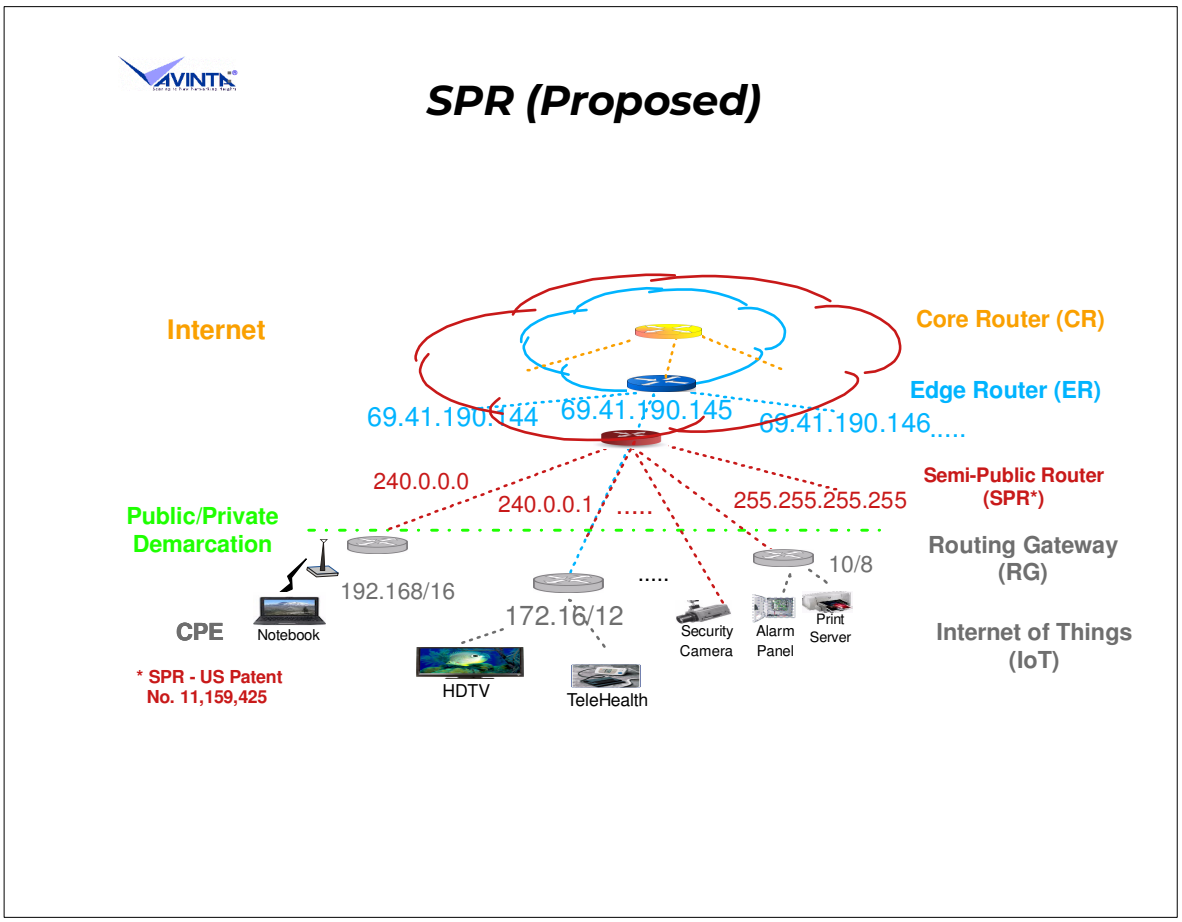
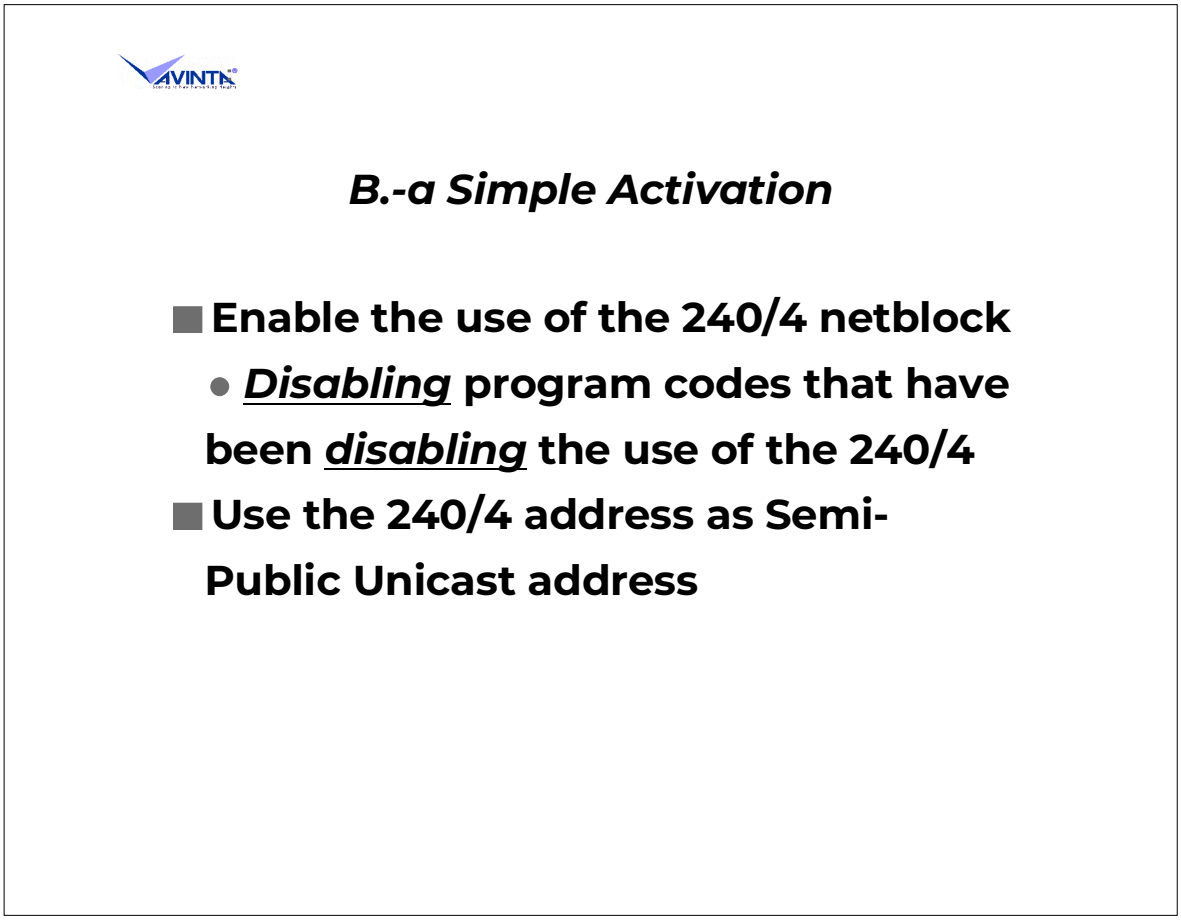


- Let's start with the basic Internet configuration: CR (Core Router) -> ER (Edge Router) -> RG (Routing Gateway) -> IoTs (Internet of Things).
- By inserting a CG-NAT router between ER and RG, each public IPv4 address is expanded by 4M fold.
- Putting CG-NAT around the Internet, the current predominate Internet architecture, CDN (Content Delivery Network) is formed.
- Each CG-NAT island has the limited address capacity of 4M.
- Within each isolated CG-NAT island with fewer than 4M subscribers, peer communication is possible.
- To make one CG-NAT island capable of serving more population, the 100.64/10 netblock has been reused dynamically, which defeats the peer communications goal.



- **Let's start from the basic Internet again.**
- **By replacing the 100.64/10 netblock with 240/4, CG-NAT routers become SPRs each 256M address capacity.**
- **Deploying SPR all around the world, an extra layer of routers are formed.**
- **This address capacity increase by 64 times is significant. For example, if each person is assigned with one 240/4 address, only 4 countries in the world have populations exceeding the capability of one SPR.**
- **In addition, each household consists of three residents on the average (based on US statistics). If the SPRs focus on serving premises, only India and China have more premises than the capacity of one SPR.**
- **Note that these are ball park number estimates for orienting our minds about what is the realistic need for a practical IP address pool.**



- For a long time, networking equipment blocked / dropped packets with 240/4 address, making such process appear to be a mystery. The actual mechanism is likely a very short screening code that recognizes the 240/4 address in an IP packet and then drops it.
- We have identified one such practical example. So, managers should take a note that software engineers declaring this as a complicated task may not know enough about their program codes.
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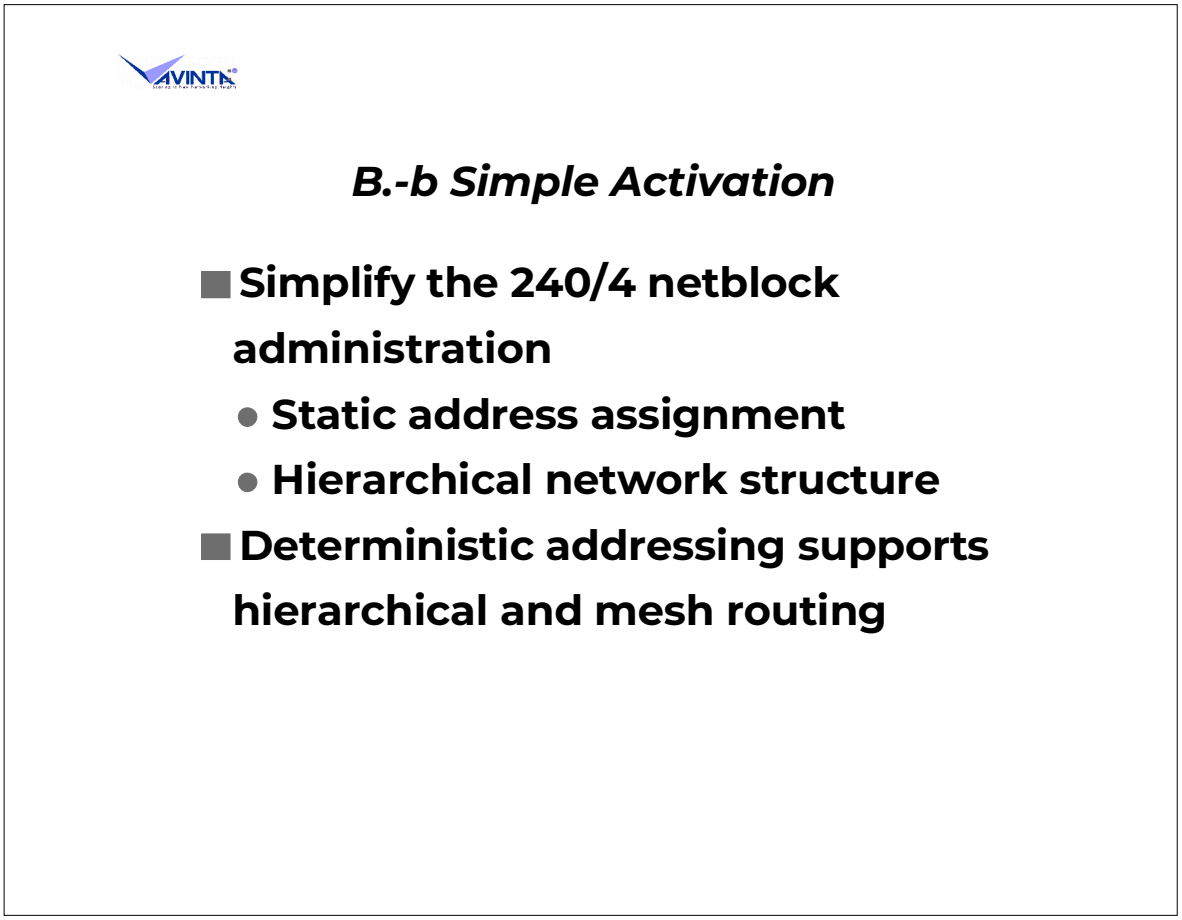


Note that dynamic addressing can not support hierarchical routing.

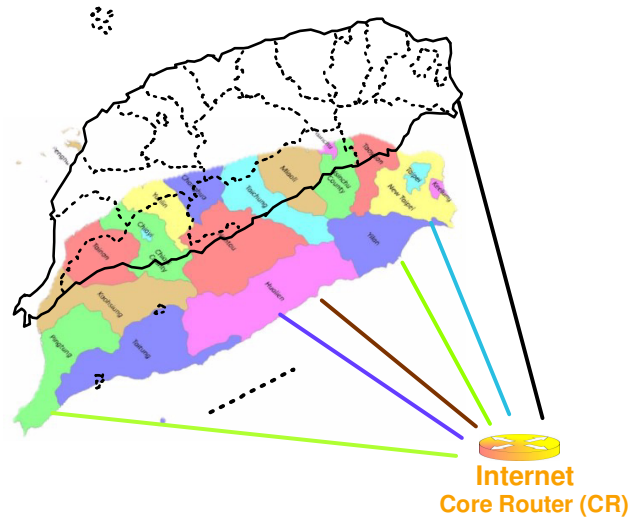
C.-a Utilize Existing Architecture

- **Apply 240/4 to CG-NAT for establishing a new set of router (SPR) between ER (Edge Router) and RG (Routing / Residential Gateway)**

C.-b Utilize Existing Architecture

- **Enhance CG-NAT routers to use both 100.64/10 and 240/4 netblocks**
- **Address pool large enough for static assignment in each practical RAN (Regional Area Network)**

D. Tethering Private Network



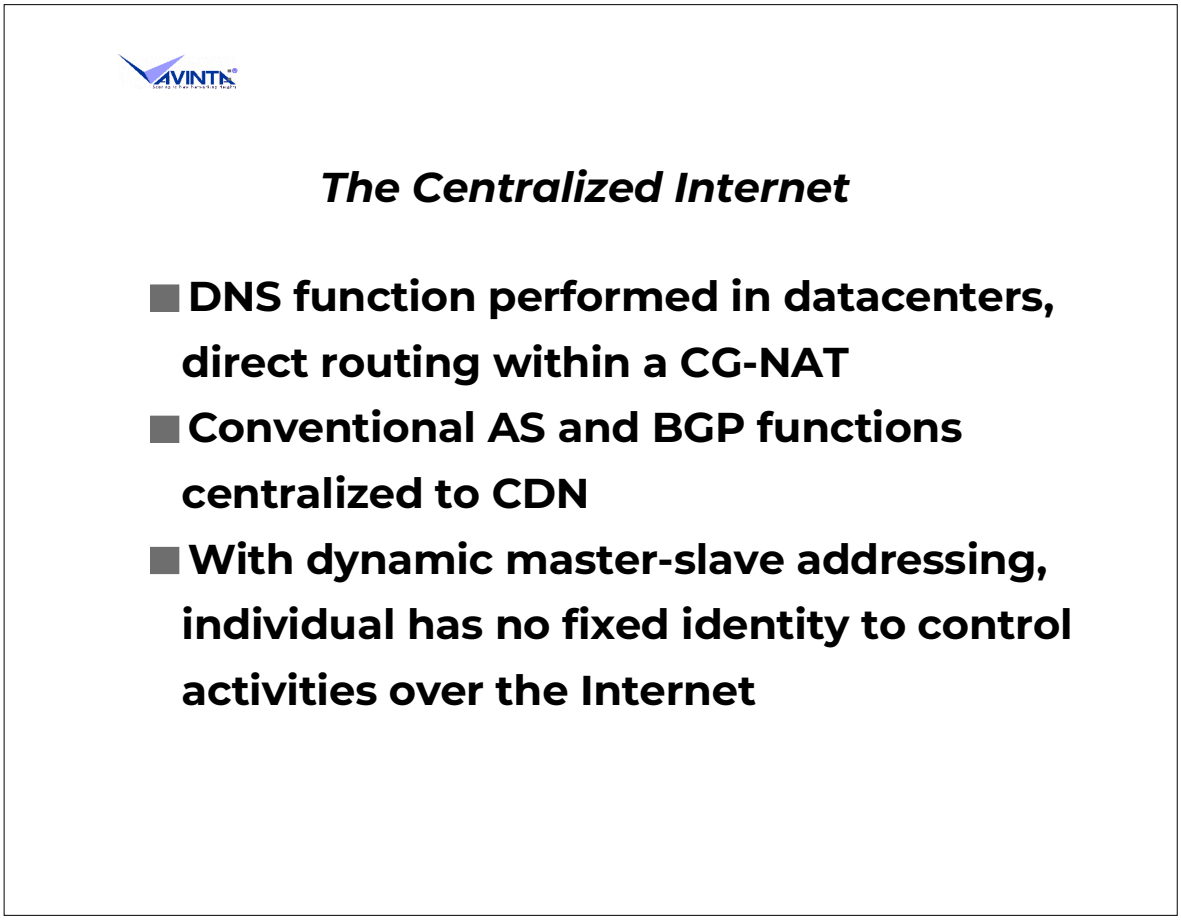
- One of the most rudimentary communications system function is to provide peer communication (or end-to-end connectivity) for every subscriber. It requires every participant to have a unique / static address.
- The current CG-NAT operation uses dynamically assigned addresses that establish a master-slave architecture for serving the CDN (Content Delivery Network) purpose well, but impedes the peer communication.
- Current Taiwan population is about 24M. With 22 municipalities, each municipality on the average, has population of a little over 1M. The 4M addresses of one 100.64/10 netblock will be used up by just three municipalities. So, only a couple of municipalities may be served by one CG-NAT island to ensure peer communication. With the tight knit municipalities across Taiwan, this is obviously not practical.
- Since an SPR island is capable of serving everyone in Taiwan by one set of static 240/4 addresses, this establishes one single peer network called RAN for the entire Taiwan tethering over the existing Internet.

E. Overlay Network to The Internet

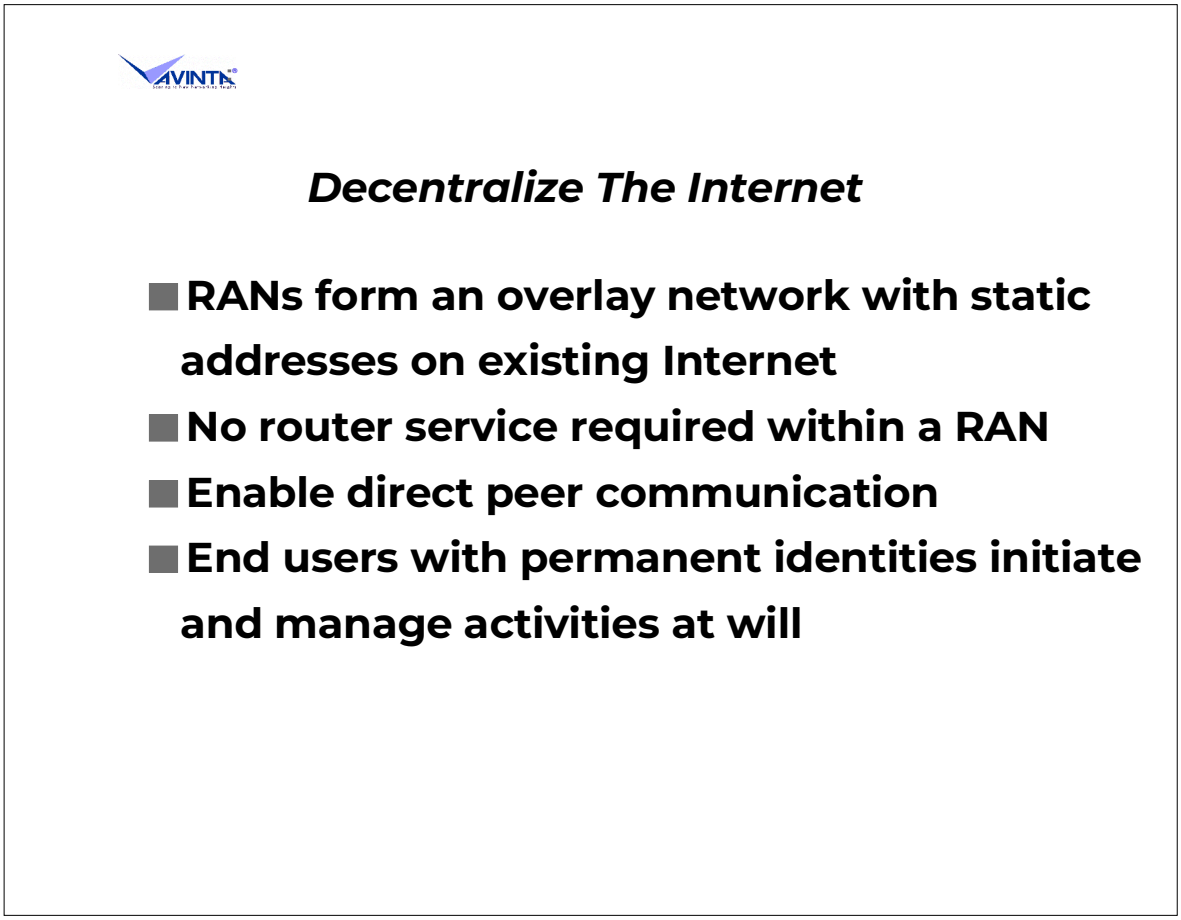
RANs form a Sub-Internet

Parallel to the Internet core

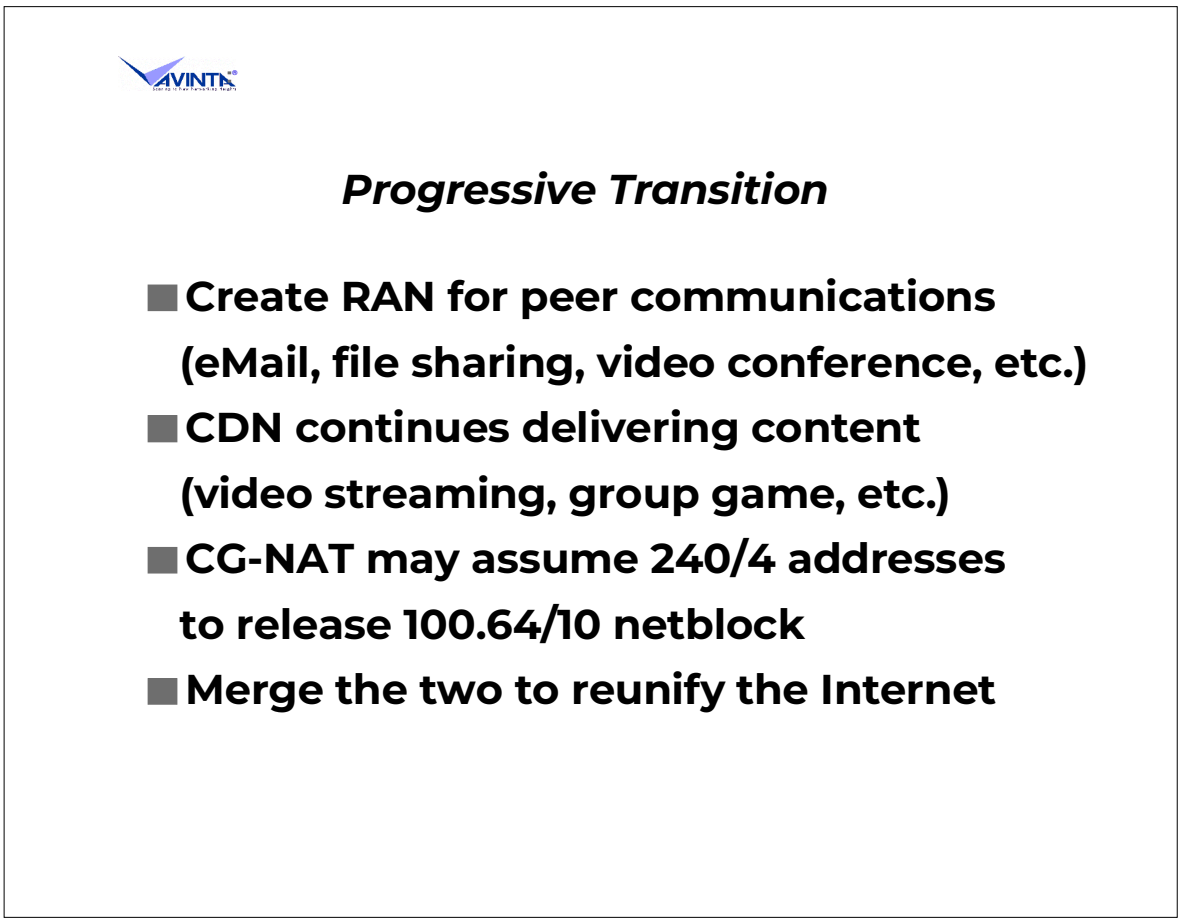
- **The single RAN per country scheme can be applied worldwide. Except, a couple may need a few RANs. Together, they form a Sub-Internet,**
- **that is parallel to the Internet Core, allowing capabilities and functions within each RANs be independently developed, as long as there are arms-length links among them through the CR for inter-RAN communication.**
- **Let's look at this situation in a big picture from 10K miles away in the space.**
- **This graphics created by Dot-Connect-Africa depicts its long time disputes with ICANN about address allocation related issues. The floated African continent in the sky implies the disagreement.**
- **Upon a closer look, other continents beyond Africa are also floating in the sky. This graphics may be interpreted as the bronze colored EzIP Sub-Internet hovering above the blue colored globe that represents the current Internet.**



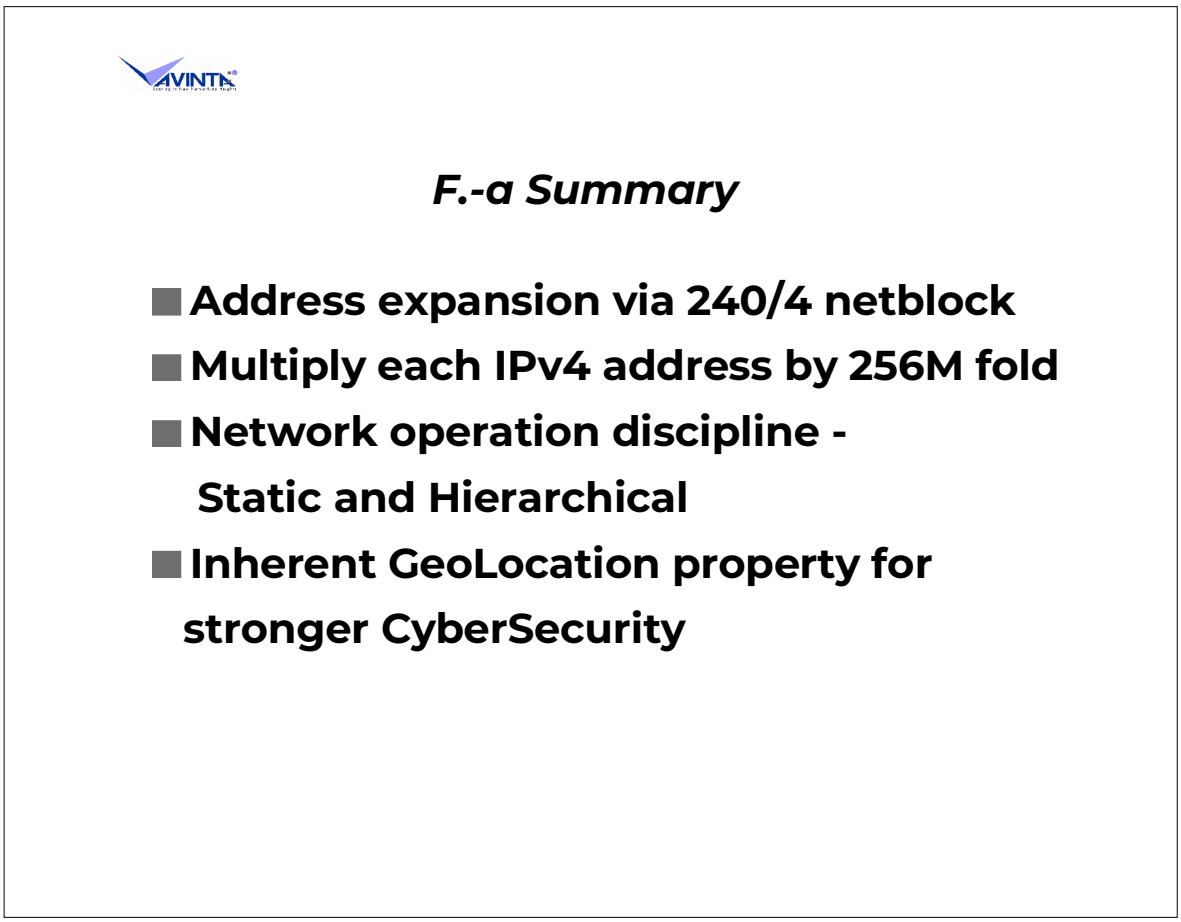
- For faster and more efficient content delivery, distributed data centers are placed near or in key markets. This started by search engines, then adopted by content delivery services. Together, this configuration serves CDN well by not only improving performances, but also lowering cost.
- The side effect of this setup simplifies the routing services to be a local process without the use of AS and BGP functions. Essentially, the DNS in the CDN Gateways took over these tasks.
- From a casual user point of view, this scheme is fine for ordinary purposes. However, this configuration deprives Individual users of the identity that is essential to initiate and manage communication with one another directly, let alone the freedom to individually innovate..



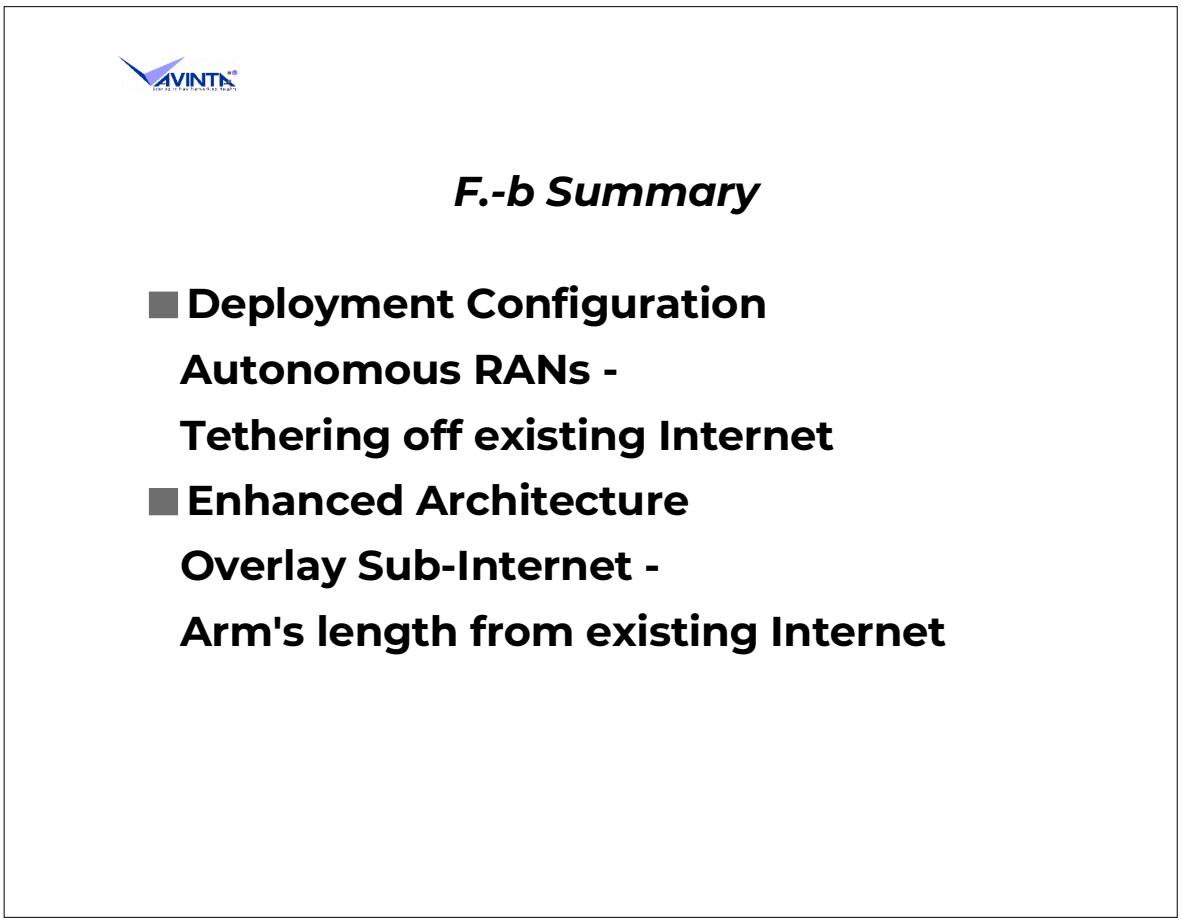
- An RAN has an **umbilical cord** (IPv4 addressed transmission channel) to the Internet core.
- Unique static addresses enable **direct L2 routing** among subscribers without relying on router service.
- ***How many in the audience remember or know about Dial-up Modems over PSTN?***
- Individuals are free to communicate **with one another at wil**l and to innovate.
- The Internet is **decentralized** because it is truly a communication backbone infrastructure supporting individualism from a user's perspective.



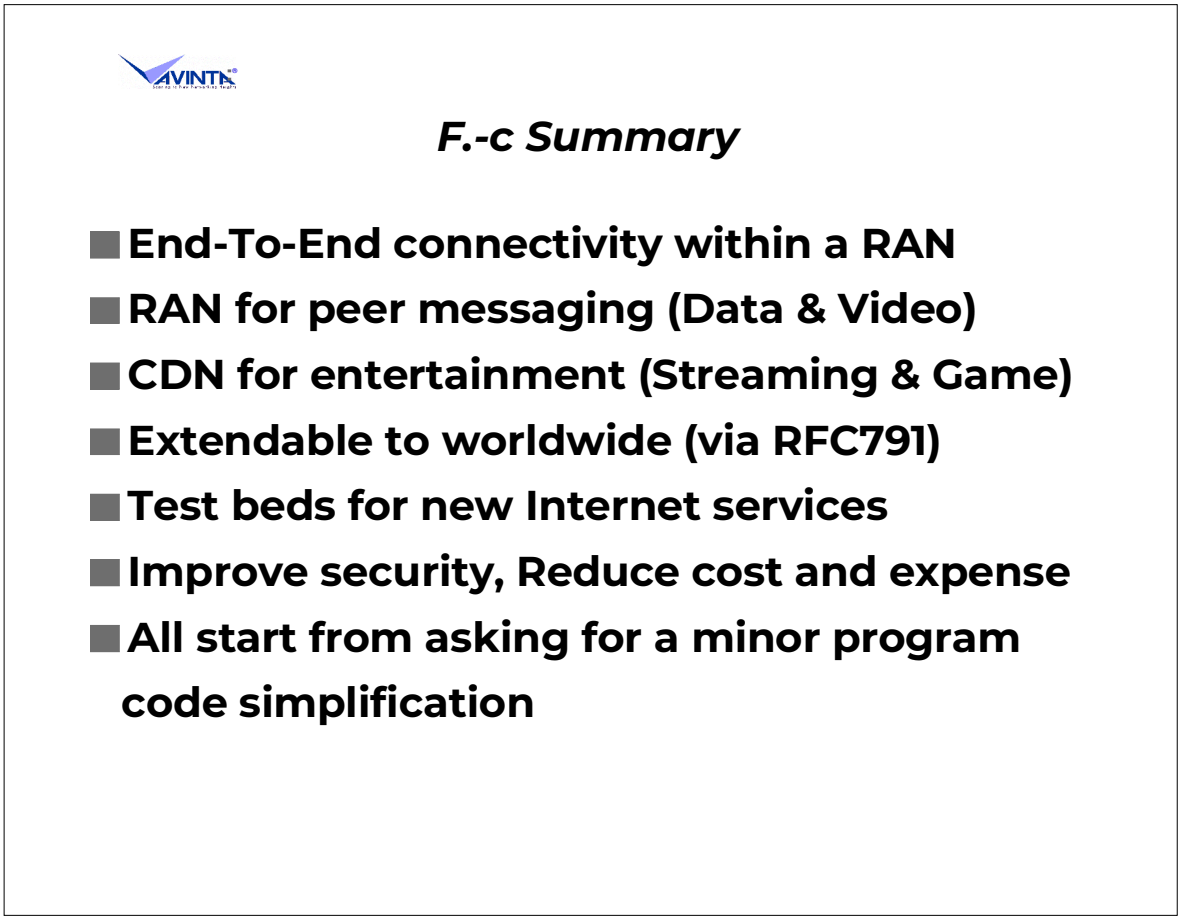
- This RAN based facility is like the **traditional postal and telephony** services,
- while the existing Internet focuses on media distributions like the **traditional broadcast and cable** services.
- Since **dynamic based operations do not mind using static address**, CG-NAT can adopt the same static 240/4 addresses that subscribes are assigned under RAN operation.
- The 100.64/10 netblock can then be released back to the **general public address pool**.
- **RAN & CDN** operations can then be **coordinated**.



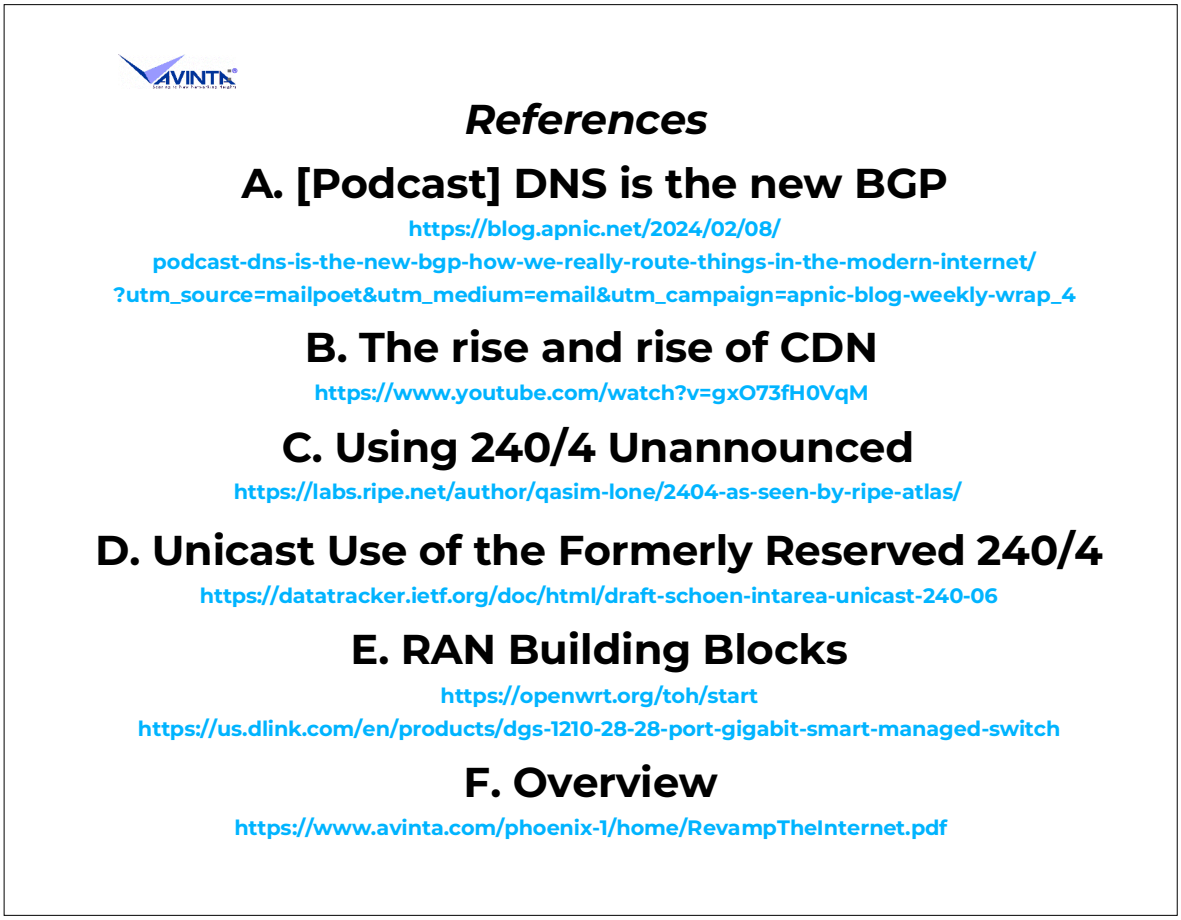
- .....
- The **RFC1918 private network addresses** can then be utilized by individual subscribers to expand respective private networks **to handle on-premises IoTs**.
- Overall Address Pool Philosophy: Instead of **IAP (Internet Access Provider) commercializes IP addresses** as **private properties**, regard them as **shared public resources**.
- Static address makes it **harder for perpetrators to hide**. .....



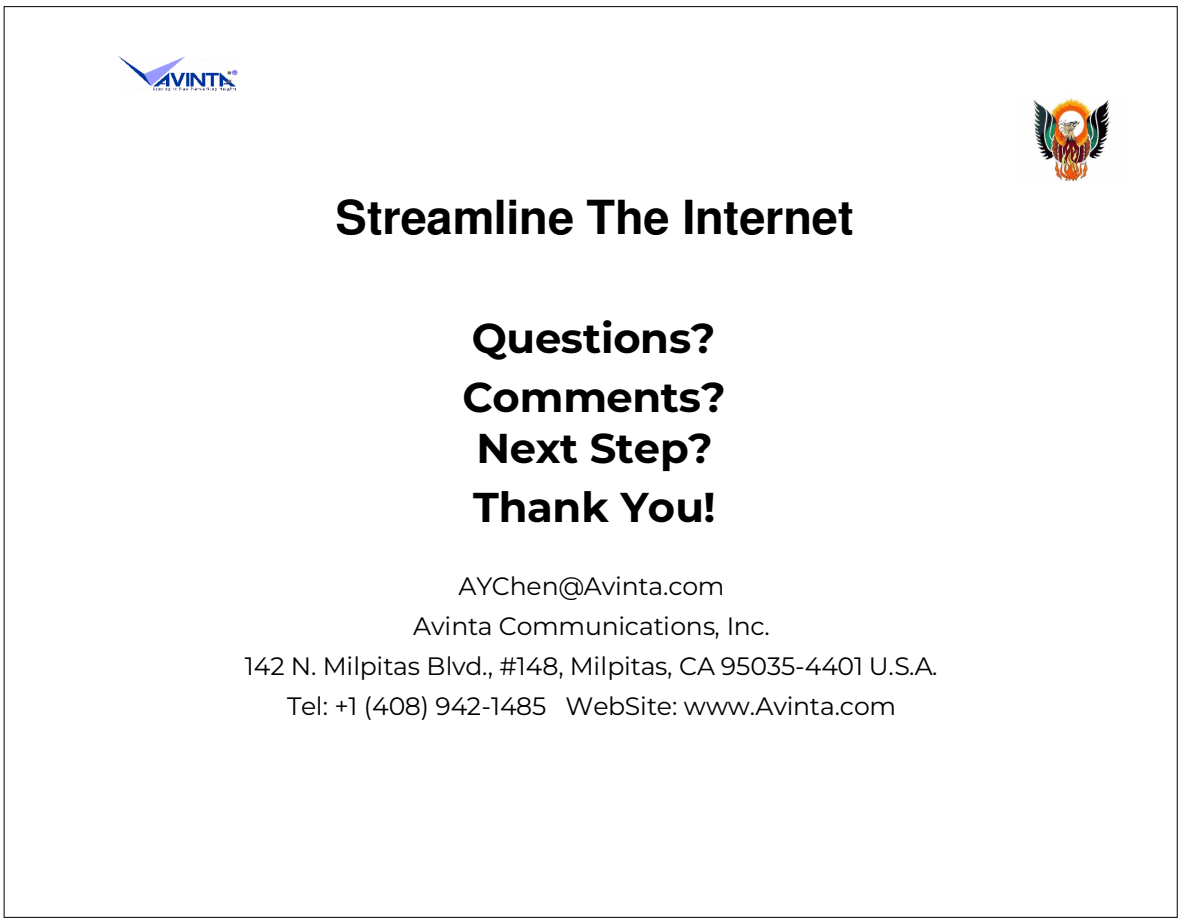
- **Each RAN can operate independent of others.**
- The only requirement is to conform with **established protocols when communicating with CR.**



- Communication within each RAN via **L2 routing**.
- **RAN: Personal communication.**
- **CDN: Entertainment**
- Utilize **Option Word mechanism defined by RFC791** to route packets among RANs via **two-level of IPv4 addresses (total of 64 bits)**. This is the same as the **country code prefixes for international telephony**. Details are in the References.
- **Note:** Since there are only **fewer than 300 jurisdictions worldwide**, **two octets of (half of) one IPv4 address** (64K combination) will be more than sufficient to identify all RANs. **The rest can be used for Test beds.**
- **Static address makes perpetrators harder to hide,** mitigates loss due to Cyber security breaches. EzIP approach offers **minimum CapEx and significant OpEx savings**
- **Code Simplification .....**



- The first two references are closely related.
- A. This **Podcast** outlines how the Internet operation becomes **relied upon CG-NAT**.
- B. This **APRICOT 2024 YouTube** describes the public communication evolution to become **centralized around CDN**.
- C. This RIPE NCC (Réseaux IP Européens Network Coordination Centre -- **Regional Internet Registry for Europe) - Lab** article reports that **multinational conglomerates** have been using 240/4 unannounced. Since they are difficult to detect, it demonstrates that **using 240/4 is not perturbing** normal Internet operations.
- D. **IPv4 Unicast Extension Project** proposes to reclassify **240/4 formerly Class E**, among a few other netblocks, as Unicast for better utilization.
- E These are **off-the-shelf networking equipment** supported by open source code from **OpenWrt** to operate with 240/4 netblock. The first are **RG level devices**. These will **buffer on-premises IoTs (including PCs)** from the 240/4 environment. The **D-Link GigaBit smart switch** can be used to start experimenting **SPRs and deploying RANs** before any **current CG-NAT router is upgraded**.
- F. This whitepaper is an EzIP proposal from a **more business prospective**. It provides **additional reference** materials, such as how to make use of RFC791.



- **Questions? .....**
- **Comments? .....**
- **Next Step?**
  - Based on material presented so far, **anytechnically capable person can deploy a RAN**, even starting from one's basement or backyard, since the use of the **240/4 netblock will not disturb the current Internet nor private network.** This is analogous to how **UNIX based network routers quietly replaced those based on Windows**.
  - Please **drop a line to us** about your thoughts and activities, so that your experiences may be **shared with other parties with similar interests.**
- Lastly, allow me to share a **layman's naive perspective**. That is, **if we treated the Internet as a packetized PSTN, the Internet could be easily streamlined.**
- **Thank You!**