FIXED WIRELESS ACCESS FOR LOW-COST HOME INTERNET

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Web location for this presentation:

http://aztcs.apcug.org

Click on

"Meeting Notes"

SUMMARY

"Fixed Wireless Access" is rapidly spreading throughout the U.S.A. It provides a low-cost alternative to traditional "broadband" Internet providers.

TOPICS

- A Demo of T-Mobile "Fixed Wireless Access" and Verizon "Fixed Wireless Access"
- Internet Access Options
- Basic Configuration of the Cell Phone System
- Two Types of Cellular Operators
- "Fixed Wireless Access" versus "Mobile Wireless Broadband"
- Gateways
- Availability of 5G Fixed Wireless Access

Internet Cloud
(= "Data Plan" in cell phone lingo)

Nokia "GATEWAY"
PROVIDED BY
T-MOBILE

Arcadyan "GATEWAY"
PROVIDED BY
VERIZON

The gateway on the left is a Arcadyan gateway provided by "Verizon Home Internet".

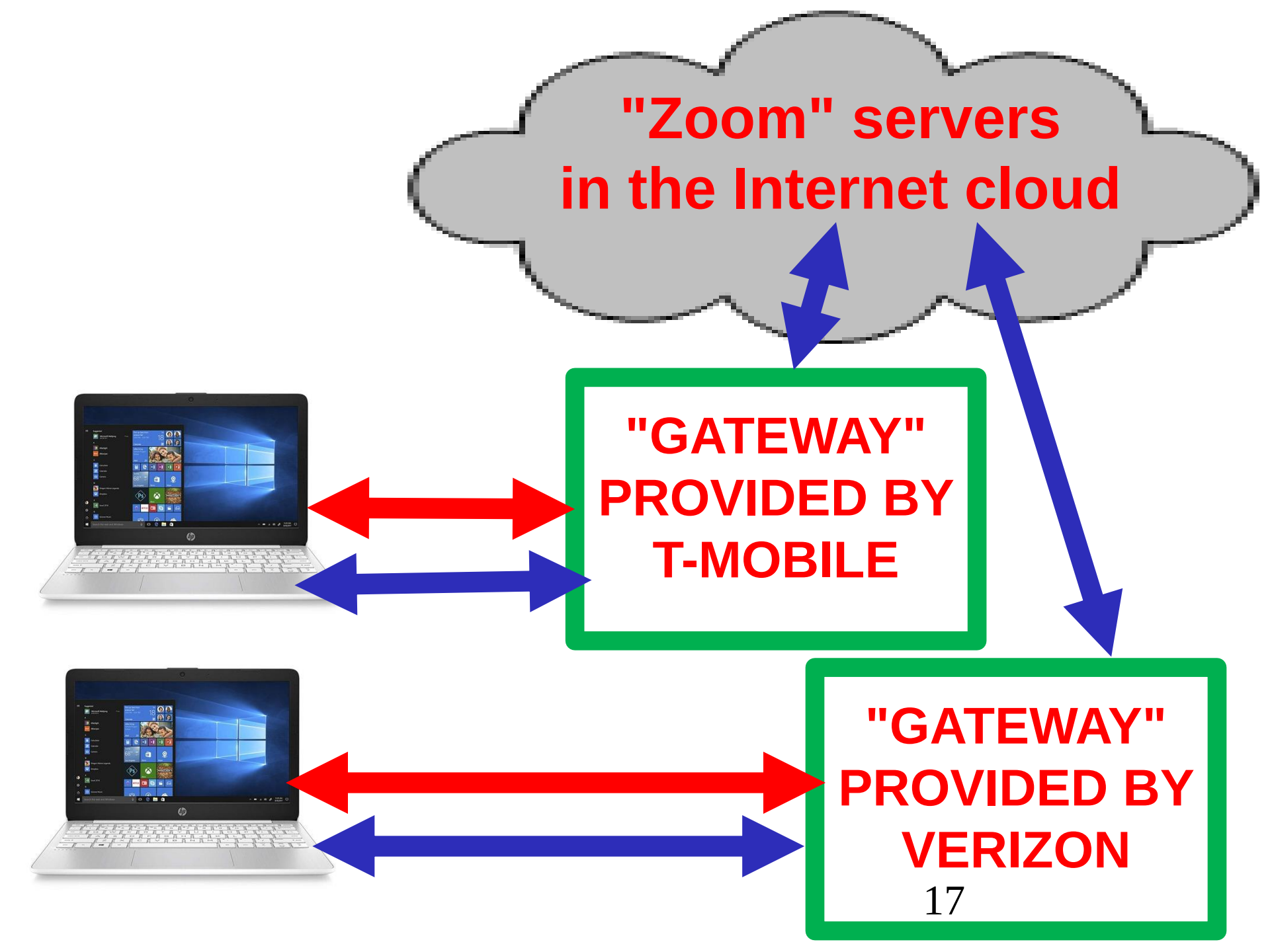
The gateway on the right is a Nokia gateway provided by "T-Mobile Home Internet"


CONNECTION

My neighbor's furniture-filled two-story home attenuates the 5G cellular signal much more than the wall of my house!


CONNECTION

Using a long Zoom meeting to test the stability of the "T-Mobile Home Internet" and the "Verizon Home Internet" services:


"Zoom" servers
in the Internet cloud
"GATEWAY"
PROVIDED BY
T-MOBILE
"GATEWAY"
PROVIDED BY
VERIZON

The "Zoom" app (in Windows 11 Home) tells you with a pop-up error message when your Internet connection is not stable enough!


Your internet connection is unstable

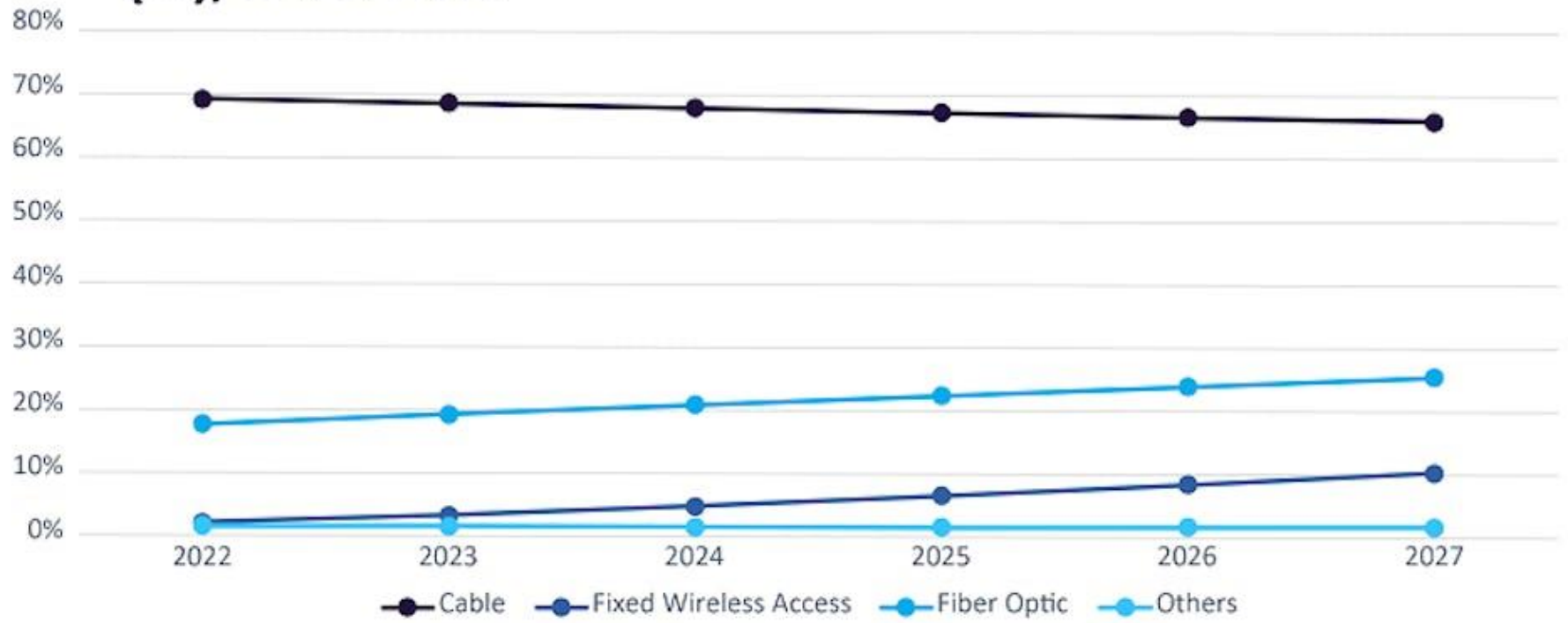
INTERNET ACCESS OPTIONS

- **Conventional "Broadband" Internet Providers** (DSL via telephone cable, cable modems, fiber-to-the-home or premise, satellite, and WISPs = "Wireless Internet Service Providers")
- **Tethering/hotspotting to a cell phone's data plan** (see my "Meeting Notes" for details)
- **5G "Fixed Wireless Access"** via Cellular MNOs and MVNOs

INTERNET ACCESS OPTIONS (continued)

- **5G "Fixed Wireless Access"** is still a very small percentage of Internet access usage but it's price advantages and ease of installation are fostering rapid growth:

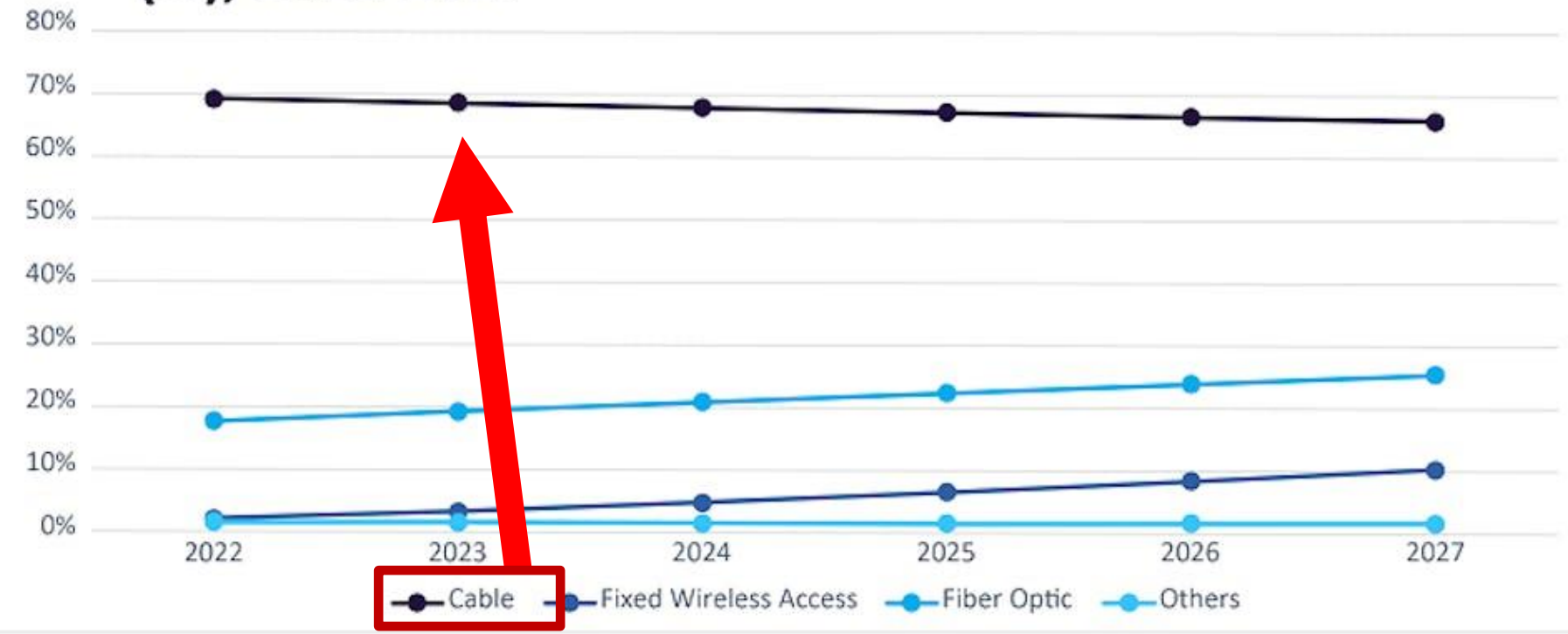
US residential broadband market share by technology (%), 2022-2027



Source: GobalData, Technology Intelligence Center

GlobalData.

US residential broadband market share by technology (%), 2022-2027



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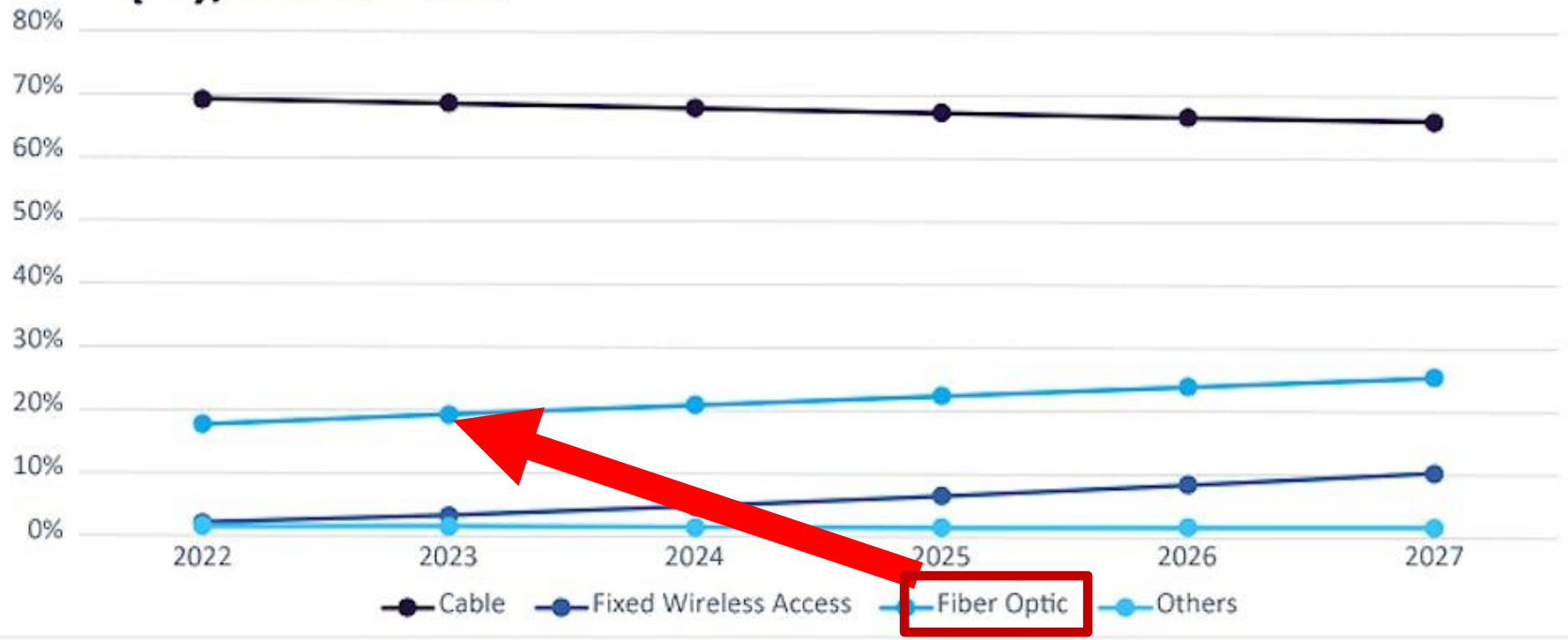

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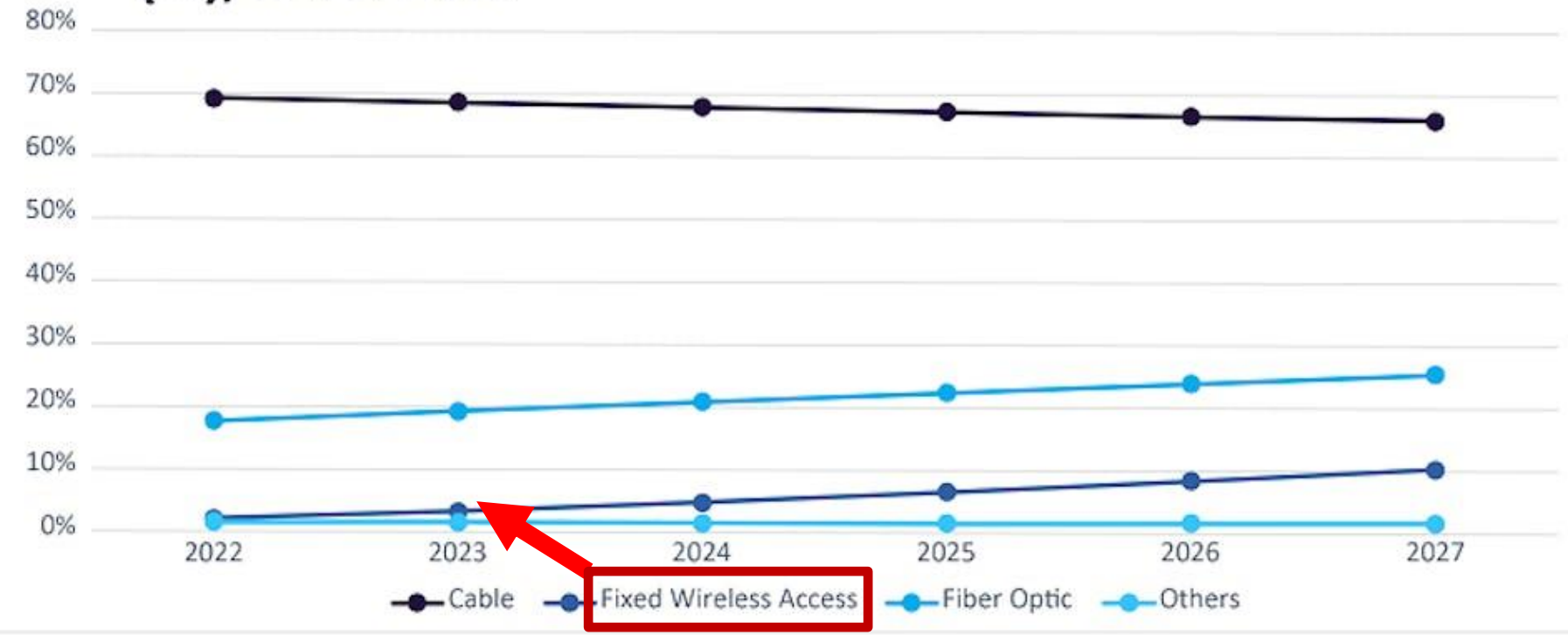
GlobalData.

US residential broadband market share by technology (%), 2022-2027



Source: GobalData, Technology Intelligence Center

GlobalData.

INTERNET ACCESS OPTIONS (continued)

- Reference for the previous slide: https://www.broadbandtechreport.com/docsis/article/14280145/report-hfc-will-remain-dominant-in-us-home-cable-broadband-market-share

INTERNET ACCESS OPTIONS (continued)

- FWA has grown at the expense of conventional Internet broadband providers:

% OF TOTAL BROADBAND NET ADDS

51.8%
T-Mobile FWA

26.5%
Verizon FWA

21.7%
Total Non-FWA

INTERNET ACCESS OPTIONS (continued)

- Reference for the previous slide: https://www.t-mobile.com/news/_admin/uploads/2022/12/2945098_CCD_State-of-Fixed-Wireless-Access_Infographic-Report_REVW_v19_RGB-2.pdf

YOUR OPTIONS FOR USING 5G "FIXED WIRELESS ACCESS"

- You can use FWA as your only Internet provider
- You can use FWA as a backup Internet provider for redundancy when you main Internet provider has a temporary outage

YOUR OPTIONS FOR USING 5G "FIXED WIRELESS ACCESS" (continued)

- You can use FWA as a supplementary Internet provider so that your main Internet provider does not get overwhelmed when it has too much utilization.

HOW DOES "FWA" COMPARE TO CONVENTIONAL "BROADBAND" INTERNET PROVIDERS?

- "FWA" has widely varying download and upload speeds relative to conventional Internet providers
- "FWA" depends on wireless radio communications of cell phone "Radio Access Networks" so blocking by neighbors may sometimes be an issue.

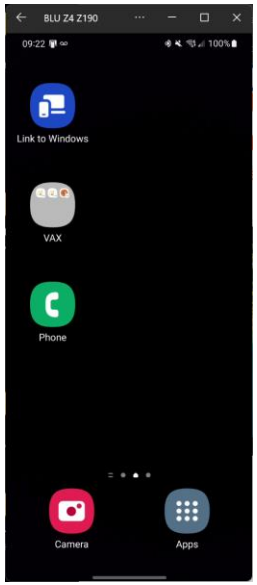
BASIC CONFIGURATION OF THE CELL PHONE SYSTEM

- For most of us, most cell phones have BOTH a radio connection to a cell phone tower AND a Wi-Fi connection to your broadband Internet provider. This gives your cell phone a much faster and almost unlimited connection to the Internet.

Internet Cloud
(= "Data Plan"
in cell phone lingo)

Public Switched
Telephone Network
("PSTN")
= "Plain Old Telephone
Service" ("POTS")

SIM



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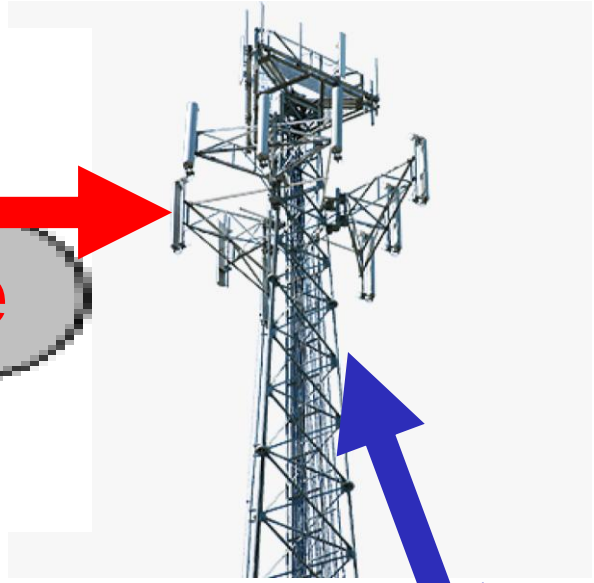
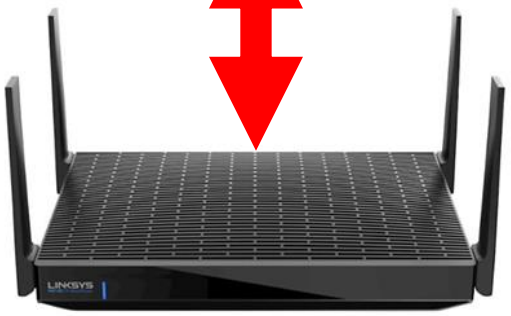
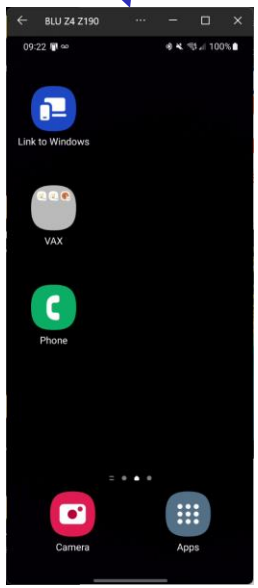


Gateway/modem connects to broadband Internet provider





Internet Cloud
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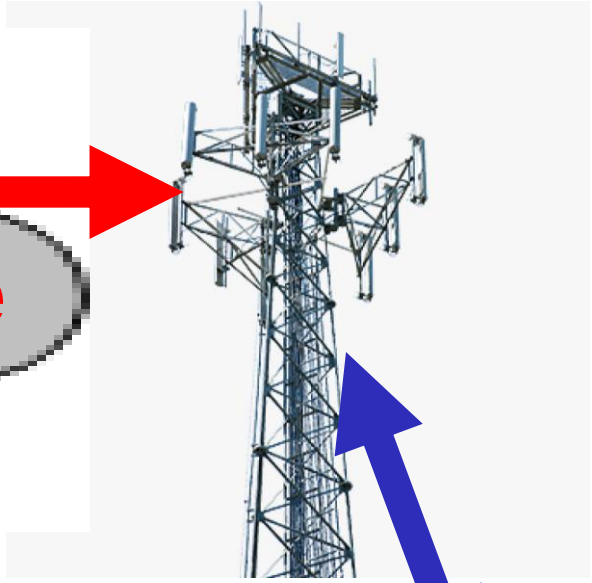
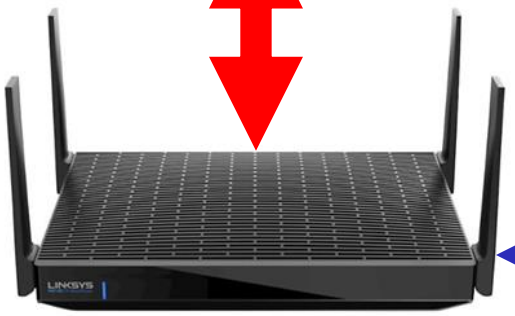
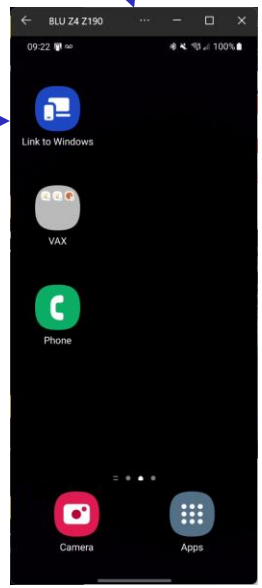


Gateway/modem connects to broadband Internet provider





Most cell phones are also connected via Wi-Fi to your home or business' Internet provider

GATEWAYS

The current gateways that are being offered to FWA customer are manufacturer by:

- Nokia (designed in Finland)
- Sagemcom (designed in France)
- Askey (Askey is a subsidiary of ASUStek, designed in Taiwan, used by Verizon)
- Arcadyan (designed in Taiwan, used by Verizon)

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GATEWAYS (continued)

- "T-Mobile Home Internet" uses gateways from all 4 of these manufacturers
- "Verizon Home Internet" uses gateways from Askey and Arcadyan

GATEWAYS (continued)

- When your self-install kit arrives, you might get a gateway made by any of these manufacturers
- Even if they charge you for the gateway that they ship you, all of the MNOs and MVOs expect you to ship the gateway back to them if you discontinue FWA service with them

GATEWAYS (continued)

- The SIM inside the gateway is a real nano-sized SIM, not an eSIM
- The SIM inside the gateway has a cellular phone number stored in it but this cellular phone number cannot be used for voice phone calls or for "Short Message Service" (= "SMS") texting

GATEWAYS (continued)

- You can think of a gateway as a cell phone with a nano-sized SIM
- SIM = "Subscriber Identification Module"
  = "Subscriber Identity Module"

From left to right: Standard SIM, Micro SIM and Nano SIM. Picture adapted from Wikipedia (

SIM Type	Alternative Name	Length (mm)	Width (mm)	Height (mm)
Standard SIM	2FF or “Mini SIM”	25.00	15.00	0.76
Micro SIM	3FF	15.00	12.00	0.76
Nano SIM	4FF	12.30	8.80	0.67

From left to right: Standard SIM, Micro SIM and Nano SIM. Picture adapted from Wikipedia (

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GATEWAYS (continued)

- Source for the previous image: https://kenstechtips.com/index.php/smartphone-type-standard-sim-micro-sim-or-nano-sim

TWO TYPES OF CELLULAR PROVIDERS

- Cell phone operators that have cell towers and interconnecting infrastructure are called **"Mobile Network Operators" (= "MNOs")**
- Cell phone operators that do not have cell towers and do not have interconnecting infrastructure are called **"Mobile Virtual Operators" ("MVNOs")**

TWO TYPES OF CELLULAR PROVIDERS (continued)

- **"Mobile Network Operators" (= "MNOs")** have their own "Radio Access Network (= "RAN")
- **"Mobile Virtual Network Operators" ("MVNOs")** use/resell the "Radio Access Network" of a "Mobile Network Operator"

TWO TYPES OF CELL SERVICE PROVIDERS (continued)

- **You can get "Fixed Wireless Access" from both MNOs and MVNOs**

TWO TYPES OF CELL SERVICE PROVIDERS (continued)

- The "Radio Access Network" of a "Mobile Network Operator" looks like this:

Your cell phone
connects via radio waves to
cell tower transmitter/receiver (of MNO)
connects to
Base Station Controller (= "BSC" of MNO)
connects to
Multiple Telephone Switching Office

(= "MTSO" of MNO)

connects to

Mobile Switching Center(s)(="MSCs" of MNO)
connects to

Public Switched Telephone Network ("PSTN")

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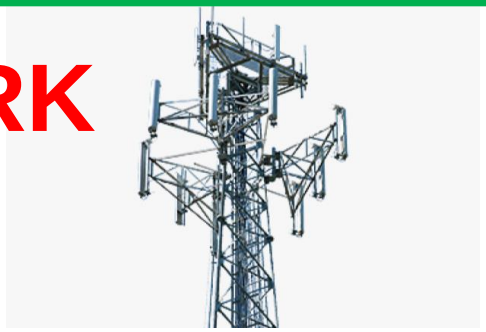
Mobile Switching Center(s)(="MSCs" of MNO)
connects to**BSS/OSS(Business support system)**
Public Switched Telephone Network ("PSTN")

Mobile Switching Center(s)
(="MSCs" of the MNO)
have a
BSS/OSS (Business support system)
that belongs to the
"Mobile Network Operator" (= MNO)

which then connects to the
BSS/OSS (Business support system)
that belongs to one or more
"Mobile Virtual Network Operators"
(= MVNOs)

When your FWA gateway (or your cell phone) connects to a Mobile Network Operator (MNO), it looks like this:

MNO's WIRELESS NETWORK INFRASTRUCTURE



FWA "GATEWAY" PROVIDED BY "MNO"

When your FWA gateway (or your cell phone) connects to a Mobile Virtual Network Operator (MVNO), it looks like this:

MNO's RADIO ACCESS NETWORK ("RAN") INFRASTRUCTURE

MNO's BSS/OSS COMPUTERS

MVNOs BSS/OSS COMPUTERS

FWA "GATEWAY" PROVIDED BY "MVNO"

BLOCK DIAGRAM SHOWING THE RELATIONSHIP BETWEEN AN MNO AND IT'S MANY MVNOs:

T-MOBILE'S RADIO ACCESS NETWORK ("RAN")

T-MOBILE'S BSS/OSS COMPUTERS

EARTHLINK'S BSS/OSS COMPUTERS

ULTRA MOBILE'S BSS/OSS COMPUTERS

METRO BY T-MOBILE'S BSS/OSS COMPUTERS

FIXED WIRELESS ACCESS VS. MOBILE WIRELESS BROADBAND

- **Fixed wireless access**
  = "Fixed wireless broadband"
  = "Fixed 5G"
- ..compared to
  "mobile wireless broadband"
  = "mobile broadband"
  = "mobile wireless"
  = "mobile 5G"
  = cellular "data plan"

FIXED WIRELESS ACCESS VS. MOBILE WIRELESS BROADBAND (cont.)

- **"Mobile Wireless Broadband"** (= "Mobile Wireless Access") consists of cell phones, cellular modems, tablets with cellular modems, cameras with cellular modems, RVs with dish antennas, etc.
  "Mobile Wireless Broadband" looks like this:

Internet Cloud
(= "Data Plan"
in cell phone lingo)

Public Switched
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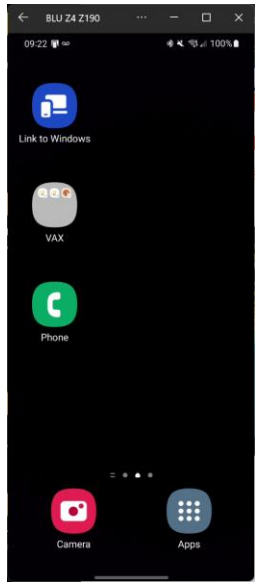
SIM



FIXED WIRELESS ACCESS VS. MOBILE WIRELESS BROADBAND (cont.)

- **"Fixed Wireless Access"** consists of radio transmitters on towers communicating with a gateway device that is meant to be moved:
  "Fixed Wireless Access" looks like this:

Internet Cloud
(= "Data Plan" in cell phone lingo)

SIM
INSIDE
FWA
"GATEWAY"
PROVIDED
BY "MNO"
OR "MVNO"

FIXED WIRELESS ACCESS VS. MOBILE WIRELESS BROADBAND (cont.)

- To relocate a "Fixed Wireless Access" gateway, you have to inform the cellular provider and get their permission
- To relocate a "Mobile Wireless Access" device, just move it somewhere and see if it connects to the Internet

FIXED WIRELESS ACCESS VS. MOBILE WIRELESS BROADBAND (cont.)

- "Fixed Wireless Access" via 4G cellular
  (= "LTE" and "LTE+")
  is horrible and not worth using
- "Fixed Wireless Access" via 5G cellular
  is a price-competitive alternative to conventional broadband Internet providers

LIST OF "MOBILE WIRELESS OPERATORS" (MNOs)

- Verizon
- T-Mobile
- Starry Internet
- USCellular
- AT&T

The above are the only cellular providers that have their own "Radio Access Networks".

DETERMINING AVAILABILITY OF FWA SERVICE

- Most "Fixed Wireless Access" Internet services do not have a data cap.
  For each of the following FWA services, assume that they do not have a data cap unless we tell you that there is one:

DETERMINING AVAILABILITY OF FWA SERVICE (continued)

- "T-Mobile 5G Home Internet" is available from "T-Mobile" which is a MNO: https://www.t-mobile.com/home-internet/eligibility?
- See also https://michaelsaves.com/reviews/t-mobile-home-internet-review/

DETERMINING AVAILABILITY OF FWA SERVICE (continued)

- "T-Mobile Home Internet Lite" is a **monthly data-capped** 4G/LTE-based form of FWA that is offered in areas where their 5G cell phone service are not available yet: https://www.t-mobile.com/support/home-internet/t-mobile-home-internet-lite

DETERMINING AVAILABILITY OF FWA SERVICE (continued)

- "T-Mobile Home Internet Lite" (continued):
  We do not recommend "T-Mobile Home Internet Lite" but in some rural areas, your only alternatives may be "Starlink" or dial-up!

DETERMINING AVAILABILITY OF FWA SERVICE (continued)

- "Verizon Home Internet" is provided by "Verizon" which is an MNO https://www.verizon.com/home/?
- See also https://www.cnet.com/home/internet/verizon-5g-home-internet-review/

DETERMINING AVAILABILITY OF FWA SERVICE (continued)

- "Starry Internet"
  is a small MNO that has FWA Internet service but no cell phone service.
  They have their own cell tower infrastructure and they are located in high density areas were traditional coax, copper, and fiber installations are cost-prohibitive.

DETERMINING AVAILABILITY OF FWA SERVICE (continued)

- Starry Internet (continued):
  To determine if their fixed wireless Internet is available at your location please go to https://starry.com/internet

DETERMINING AVAILABILITY OF FWA SERVICE (continued)

- "Metro by T-Mobile" is an MVNO that resells T-Mobile cell service. "Metro by T-Mobile" has "T-Mobile 5G Home Internet" See https://www.metrobyt-mobile.com/plans/home-internet?

DETERMINING AVAILABILITY OF FWA SERVICE (continued)

- "Visible" is an MVNO that resells Verizon cell service.
  "Visible" offers
  "Verizon Home Internet"
  See
  https://www.visible.com/plans/home-internet

DETERMINING AVAILABILITY OF FWA SERVICE (continued)

- "Visible" (continued)"

  "Visible" is apparently only willing to provide "Verizon Home Internet" as a bundle that also has at least one "Visible by Verizon" cellular phone number.

  If you are already a Visible cellular customer, their FWA is probably a great, low-cost deal.

DETERMINING AVAILABILITY OF FWA SERVICE (continued)

- "Earthlink" is an MVNO that resells T-Mobile cell service.
  "Earthlink" resells Earthlink's FWA as "Earthlink Wireless Home" **with a monthly data cap**
  See https://www.earthlink.net/internet/wireless-home-internet/
  and phone them at 866-311-2093.

DETERMINING AVAILABILITY OF FWA SERVICE (continued)

- "Ultra Mobile" is an MVNO that resells T-Mobile cellular service. "Ultra Mobile" resells T-Mobile's FWA as "Ultra Home Internet"
  See https://homeinternet.ultramobile.com/coverage
  and
  https://homeinternet.ultramobile.com/

DETERMINING AVAILABILITY OF FWA SERVICE (continued)

- "Ultra Mobile" (continued)
  "Ultra Mobile" is apparently only willing to provide "Ultra Home Internet" as a bundle that also has at least one "Ultra Mobile" cellular phone number.

DETERMINING AVAILABILITY OF FWA SERVICE (continued)

- Cricket Wireless
  is an MVNO that resells "AT&T Mobility".
  "Cricket Wireless" does not have FWA yet.

DETERMINING AVAILABILITY OF FWA SERVICE (continued)

- "Mint Mobile" is an MVNO that resells "T-Mobile"
  but "Mint Mobile" does not have FWA yet:

DETERMINING AVAILABILITY OF FWA SERVICE (continued)

- "Mint Mobile"..(continued): https://www.cnn.com/2023/03/15/tech/mint-mobile-tmobile-purchase-ryan-reynolds/index.html#:~:text=T%2DMobile%20announced%20Wednesday%20that,service%2C%20and%20wireless%20wholesaler%20Plum

DETERMINING AVAILABILITY OF FWA SERVICE (continued)

- "Broadband Q Wireless" is an MVNO that resells Verizon, T-Mobile, and AT&T. "Broadband Q Wireless" resells cellular FWA that is mainly offered in rural areas.

DETERMINING AVAILABILITY OF FWA SERVICE (continued)

- "Broadband Q Wireless" (continued):
  See https://www.broadbandqwireless.com
  and https://themescene.tv/internet/broadband-q-wireless-internet-review/

DETERMINING AVAILABILITY OF FWA SERVICE (continued)

- "Broadband Q Wireless" (continued):
  Contact:
  Steven Rodden
  s_rodden@hotmail.com
  text: 850-820-2504
  cell phone: 781-336-6652

DETERMINING AVAILABILITY OF FWA SERVICE (continued)

- "Straight Talk" is an MVNO that resells AT&T, T-Mobile, and Verizon To determine availability, please go to https://www.straighttalk.com/home-internet/check-availability?callback=https://www.straighttalk.com/devices/home-internet

DETERMINING AVAILABILITY OF FWA SERVICE (continued)

- "USCellular" is an small MNO that has it's own "Radio Access Network" equipment. To determine availability of their "5G Unlimited Home Internet" or their "4G Unlimited Home Internet", please go to https://www.uscellular.com/home-internet and/or https://www.uscellular.com/high-speed-internet-provider

DETERMINING AVAILABILITY OF FWA SERVICE (continued)

- "AT&T Home Internet": See https://www.att.com/internet/fixed-wireless/
- Most of AT&T's "Fixed Wireless Internet" is based on the older 4G/LTE/LTE+ cellular technology
- Beware of their "5GE" cell phone service which is actually 4G/LTE/LTE+

DETERMINING AVAILABILITY OF FWA SERVICE (continued)

- "AT&T Home Internet" (continued)
  https://www.whistleout.com/Internet/Guides/guide-to-att-5g-home-internet
  AT&T also has fiber-based Internet and ADSL copper-pair based Internet with unclear distinction in the naming of these options.

DETERMINING AVAILABILITY OF FWA SERVICE (continued)

- "NetAllOver" is an MVNO that resells AT&T.
  To determine availability, please go to https://netallover.com/internet-provider/

APPENDIX 1: MVNOs in the U.S.A.

- https://www.whistleout.com/CellPhones/Guides/which-network-is-your-mvno-on
- https://www.apnsettings.org/us/list-of-mvnos-in-us/#:
- https://en.wikipedia.org/wiki/List_of_United_States_mobile_virtual_network_operators

APPENDIX 1: MVNOs in the U.S.A. (continued)

- https://bestmvno.com/mvnos/
- https://i.redd.it/zwhj99l8gjoa1.jpg

APPENDIX 2: HISTORICAL EVENTS

- 1992: **Wireless Internet Service Providers (WISPs)** in rural areas: 900 MHz "subscriber modules" with outdoor antennas

  2017: **Citizens Broadband Radio Service (CBRS)** at 3.5 Gigahertz
- 2019: **Wireless Internet Service Providers (WISPs) based on 2.45 GHz Wi-Fi** (also)
- 2021: **"FWA" from "MNOs" and "MVNOs"**

APPENDIX 3: CENTURYLINK

- "CenturyLink Wireless Internet for rural areas" requires the installation of an outdoor antenna at the subscriber's premises: https://www.centurylink.com/home/help/internet/fixed-wireless-internet.html and https://www.centurylink.com/home/help/internet/rural-internet-options.html

APPENDIX 3: CENTURYLINK (continued)

- "CenturyLink Wireless Internet has some conventional "Wireless Internet Service Provider" towers using the "Citizens Broadband Radio Service" at
  ~3.5 Gigahertz as explained at https://www.fiercetelecom.com/telecom/centurylink-counts-28-towers-its-roadmap-for-fixed-wireless

APPENDIX 3: CENTURYLINK (continued)

- https://www.telecompetitor.com/wisps-get-cbrs-range-as-great-as-six-miles-at-100-mbps-speeds/
- https://en.wikipedia.org/wiki/Citizens_Broadband_Radio_Service