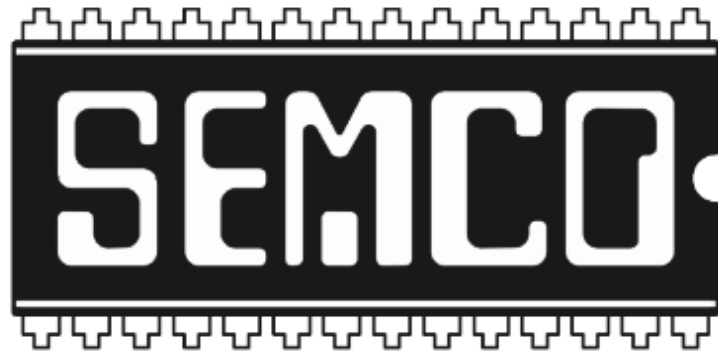


1: CELL PHONES OVERVIEW

by Francis Chao
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TuCS COMPUTER
Son
SOCIETY



An International
Association of Technology
& Computer User Groups

**Web location for this
presentation:**

<http://aztcs.apcug.org>

Click on

"Meeting Notes"

SUMMARY

Your smart Android or iPhone cell phone is actually 6+ separate radio transmitter-receivers in a very compact device. If you get a working understanding the petty details of these 6+ transmitter-receivers, you can make better use of your smart cell phone and save money.

TOPICS

- Two Types of Cell Phones
- SIM versus eSIM
- Basic Uses For a Smart Cell Phone
- 6+ Transmitter-receivers In A Smart Cell Phone
- Sensors in Smart Cell Phones
- Not Having a Data Plan
- Having a Data Plan But Using It Wisely

TWO TYPES OF CELL PHONES

- "iPhones.." from Apple
- Android phones from all other manufacturers:
Samsung, Blu, Moto, etc

TWO TYPES OF CELL PHONES

(continued)

- "iPhones" run Apple's iOS operating system
- "Android" phones run "Android" which is a "modified version of the Linux kernel" as explained at [https://en.wikipedia.org/wiki/Android_\(operating_system\)](https://en.wikipedia.org/wiki/Android_(operating_system))

TWO TYPES OF CELL PHONES (continued)

- As of May 2023 for the U.S.A.:
Android cell phones had about 37 percent of the usage share
AND
Apple iPhones had about 62 percent of usage share:

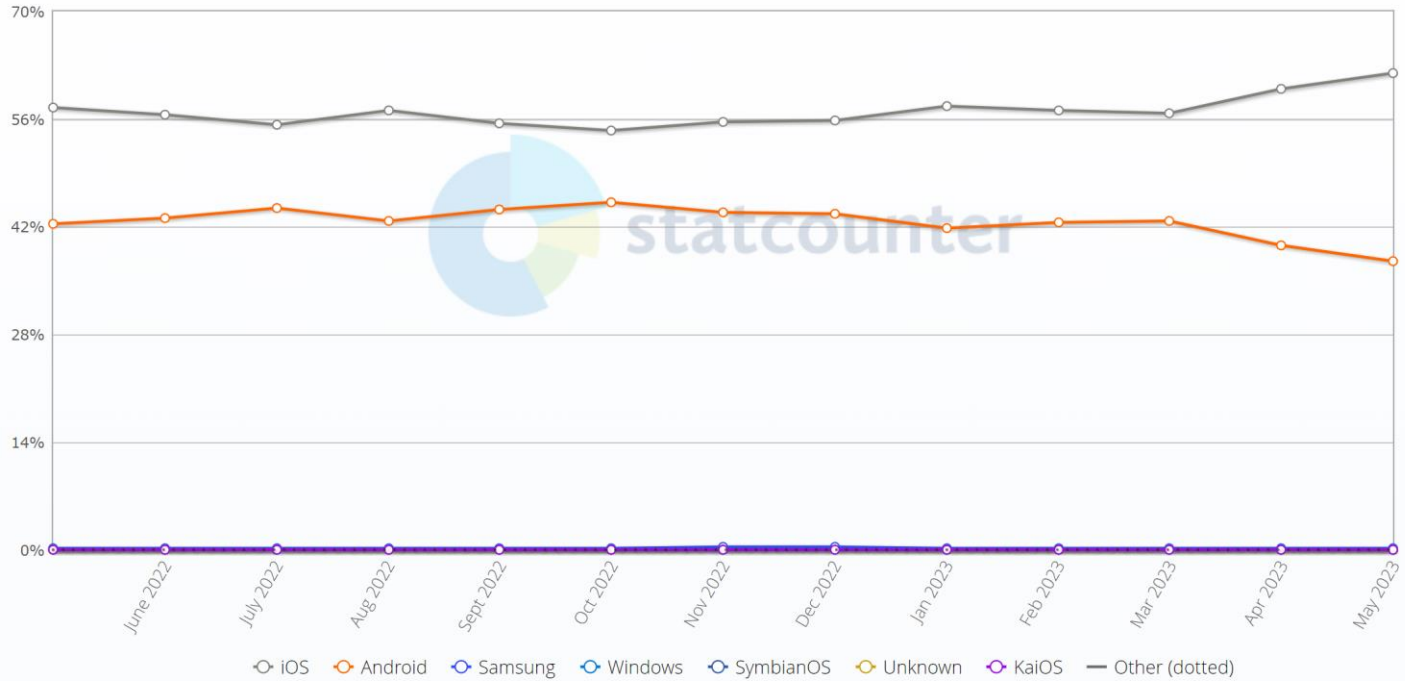
iOS	Android	Samsung	Windows	Unknown	Linux
62.13%	37.47%	0.28%	0.05%	0.02%	0.02%

Mobile Operating System Market Share in United States Of America - May 2023

Mobile Operating System Market Share United States Of America

May 2022 - May 2023

Edit Chart Data



ios

62.13%

Android

37.47%

TWO TYPES OF CELL PHONES

(continued)

- Source for the two previous slides:
<https://gs.statcounter.com/os-market-share/mobile/united-states-of-america/>

TWO TYPES OF CELL PHONES

(continued)

- This is "usage share".
Most statistics that you find will show "shipments per quarter or year" in terms of of "dollars" and they will show higher values for iPhones because iPhones average much higher in average price relative to Android cell phones.

SIM VERSUS eSIM

- SIM = "Subscriber Identity Module"
- eSIM = "embedded Subscriber Identity Module"

SIM VERSUS eSIM (continued)

- With the exception of really-old now-obsolete phones that were used Verizon's former "CDMA" system, all current cell phones have at least one SIM slot in them.

SIM VERSUS eSIM (continued)

- "CDMA"
= "Code-Division Multiple Access" =
former cell phone system that
Verizon utilized in in the United
States until 1 year ago
The Verizon cell phone carrier will
no longer support 3G/"CDMA"
phones at the end of the 2022
calendar year.



SIM VERSUS eSIM (continued)

- An eSIM module is actually a chip inside the cell phone that you or your cellular phone salesperson configures using either a special carrier-provided app or using the "Settings" function inside a cell phone:

SIM VERSUS eSIM (continued)

- To configure an eSIM inside an iPhone XS or higher, see [https://appletoolbox.com/how-to-use-dual-sim-and-esim-on-iphone-xr-and-xs/#How To Set-Up eSIM on Your iPhone](https://appletoolbox.com/how-to-use-dual-sim-and-esim-on-iphone-xr-and-xs/#How_To_Set_Up_eSIM_on_Your_iPhone)

SIM VERSUS eSIM (continued)

- Some Android cell phones have two SIM slots.

Android phone manufacturers call this "dual SIM" in their specifications.

SIM VERSUS eSIM (continued)

- Some cell phones will have both a SIM slot and an eSIM chip: one example is Apple's iPhone XS and higher models of iPhones. Apple refers to having both a SIM slot and an eSIM as being "dual SIM".

SIM VERSUS eSIM (continued)

- Three different sizes of "SIM" modules:
Most current models of cell phones have a "Nano SIM":
It is about the size of your smallest fingernail:



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

SIM VERSUS eSIM (continued)

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

SIM VERSUS eSIM (continued)

- According to

<https://support.apple.com/en-us/HT209044#:~:text=iPhone%20XS%2C%20iPhone%20XS%20Max,nano%2DSIM%20and%20an%20eSIM.&text=An%20eSIM%20is%20a%20digital,use%20a%20physical%20nano%2DSIM> :

iPhone XS, iPhone XS Max, iPhone XR, and later feature Dual SIM with a nano-SIM and an eSIM.¹ An eSIM is a digital SIM that allows you to activate a cellular plan from your carrier without having to use a physical nano-SIM.

SIM VERSUS eSIM (continued)

- See

<https://support.apple.com/en-us/HT202645>

for which model of iPhone has
which model of SIM card

6+ TRANSMITTER-RECEIVERS IN A SMART CELL PHONE

1. Cellular transceiver
2. Wi-Fi transceiver
3. Global Navigation Satellite System receiver (= GPS receiver)
4. Bluetooth transceiver
5. Near-field Communication transceiver (=NFC transceiver)
6. Ultra Wide Band (UWB) transceiver

6+ TRANSMITTER-RECEIVERS IN A SMART CELL PHONE (continued)

7. FM radio receiver (some Androids)

1. 8. "Magnetic Secure Transmission" transmitter

(= "MST" transmitter in some Samsung Androids only)

In January 2021 with the

introduction of the S21 models,

Samsung discontinued the use of

"MST".

6 TRANSMITTER-RECEIVERS IN A SMART CELL PHONE

- Any smart phone app that does not have an Internet connection for regular operations (i.e. that does not have a Wi-Fi connection or a data plan) still will require an Internet connection when you are installing an app (for the first time) or when you are upgrading an app

1. CELLULAR TRANSCEIVER

- Transmitter/receivers located at cell tower sites
- Digital signals on most phone calls route to the "Public Switched Telephone Network" (PSTN)
- Voice traffic for phone calls through cell phone towers is mandatory
- Optional "Data Plan" traffic through cell towers usually costs extra

Cell phone

connects via radio waves to

cell tower transmitter/receiver (of carrier)

connects to

Base Station Controller (= "BSC" of carrier)

connects to

Multiple Telephone Switching Office

("MTSO" of carrier)

connects to

Mobile Switching Center ("MSC" of carrier)

connects to

Public Switched Telephone Network ("PSTN")

1. CELLULAR TRANSCEIVER (continued)

The next slide uses only the cell system acronyms to save on space:

Cell phone
connects to

cell tower transmitter/receiver

connects to
"BSC"

connects to
"MTSC"

connects to
"MSC"

connects to
"PSTN"

1. CELLULAR TRANSCEIVER

(continued)

- When a cell phone calls another cell phone that is using the same carrier, the call is routed between "Mobile Switching Centers" ("MSCs") that belong to the same carrier: the call is NOT routed through the "Public Switched Telephone Network":

Cell phone
connects to
cell tower
connects to
"BSC"
connects to
"MTSC"
connects to
"MSC"
connects to
"PSTN"

Cell phone
connects to
cell tower
connects to
"BSC"
connects to
"MTSC"
connects to
"MSC"
connects to
"PSTN"



1. CELLULAR TRANSCEIVER

(continued)

- When a cell phone calls a cell phone of another cell phone carrier or a land-line phone, the call is routed out through the "Public Switched Telephone Network":

Cell phone
connects to
cell tower
connects to
"BSC"

connects to
"MTSC"

connects to
"MSC"

connects to
"PSTN"

Cell phone
connects to
cell tower
connects to
"BSC"

connects to
"MTSC"

connects to
"MSC"

connects to
"PSTN"



2. Wi-Fi TRANSCEIVER

"Wi-Fi 4" = 802.11n: both 2.45 GHz and 5.0 GHz radio bands

"Wi-Fi 5" = 802.11ac: only on 5 GHz

"Wi-Fi 6" = 802.11ax: both 2.45 GHz and 5 GHz

"Wi-Fi 6E" = 802.11ax revision 2021: 2.45 GHz, 5 GHz, and 6 GHz

2. Wi-Fi TRANSCEIVER (continued)

- Used to give the phone Internet access for Internet functions
- "Wi-Fi Calling":
Most phones can route voice calls over the Internet (instead of through the cell carrier's cell towers) if the Wi-Fi signal that they are connected to is fast enough

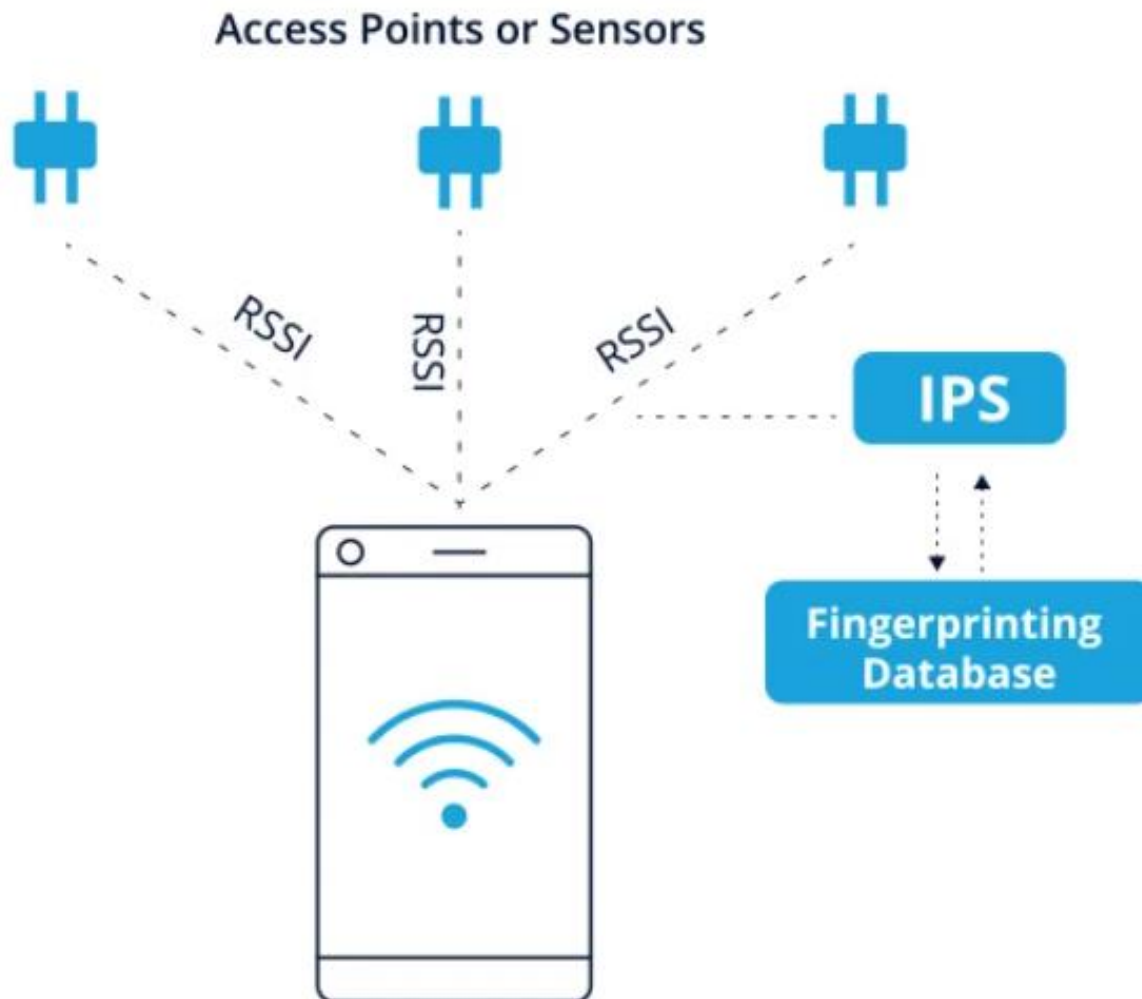
- ## 2. Wi-Fi TRANSCEIVER (continued)
- Can be used to tether your "data plan" Internet access to other devices if "Personal Hotspot" is turned on
 - Most map apps and navigation apps use both GPS data and Wi-Fi "RSSI fingerprinting" from your cell phone to pinpoint or approximate your location.

2. Wi-Fi TRANSCEIVER (continued)

- When it is enabled, the "Location Services" in your cell phone reports the following to the a "Location Services" database that is provided by your cell phone company:
 1. GPS coordinates
 2. SSIDs, BSSIDs, and RSSIs of all detected "Wireless Access Points" (from routers, mesh nodes, and Wi-Fi extenders)

2. Wi-Fi TRANSCEIVER (continued)

- The Wi-Fi transceiver in your cell phone is used to participate in the "RSSI Fingerprinting" database that is used by the operating system (Android or iOS) of your cell phone. This capability is part of the "Location Services" of your cell phone:



2. Wi-Fi TRANSCEIVER (continued)

- Reference for the prior illustration:
- <https://www.inpixon.com/technology/standards/wifi>

2. Wi-Fi TRANSCEIVER (continued)

- A "RSSI fingerprinting" system uses "Relative Signal Strength Indications" values to estimate the location of a cell phone by converting the RSSI values that are reported by your cell phone into approximate distance vectors are illustrated by

<https://3roam.com/wi-fi-range-calculator/>

3. GLOBAL NAVIGATION SATELLITE SYSTEMS (GNSS) RECEIVER

- All 5 GNSS systems use "Low Earth Orbit" ("LEO") satellites (~1200 Miles altitude):
 1. GPS = Global Positioning System (US)
 2. GLONASS = Global Navigation Satellite System (Russia)

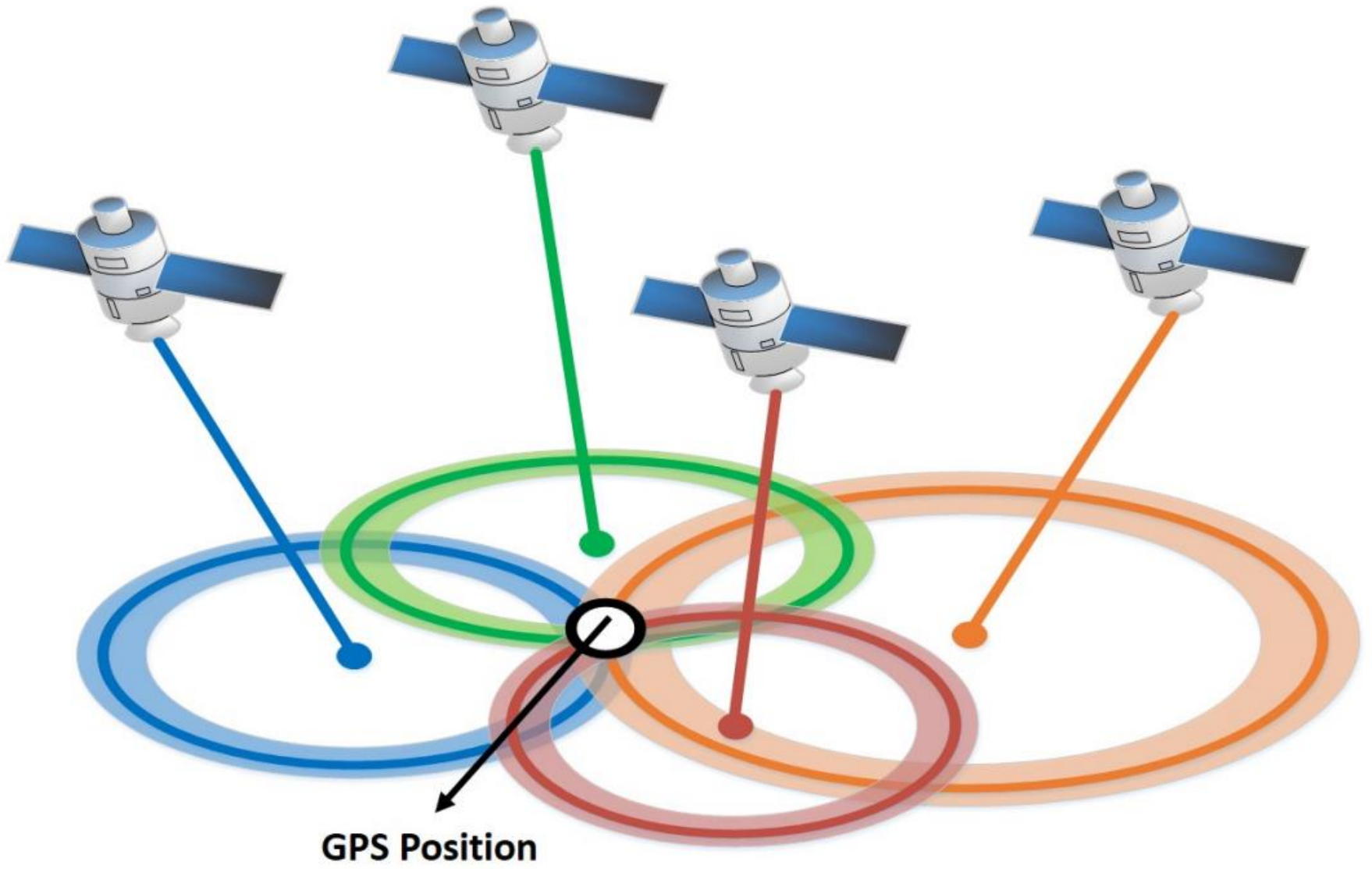
3. GLOBAL NAVIGATION SATELLITE SYSTEMs (GNSS) RECEIVER (continued)

3. Galileo (European Union)

4. BeiDou Navigation Satellite System

(Peoples Republic of China)

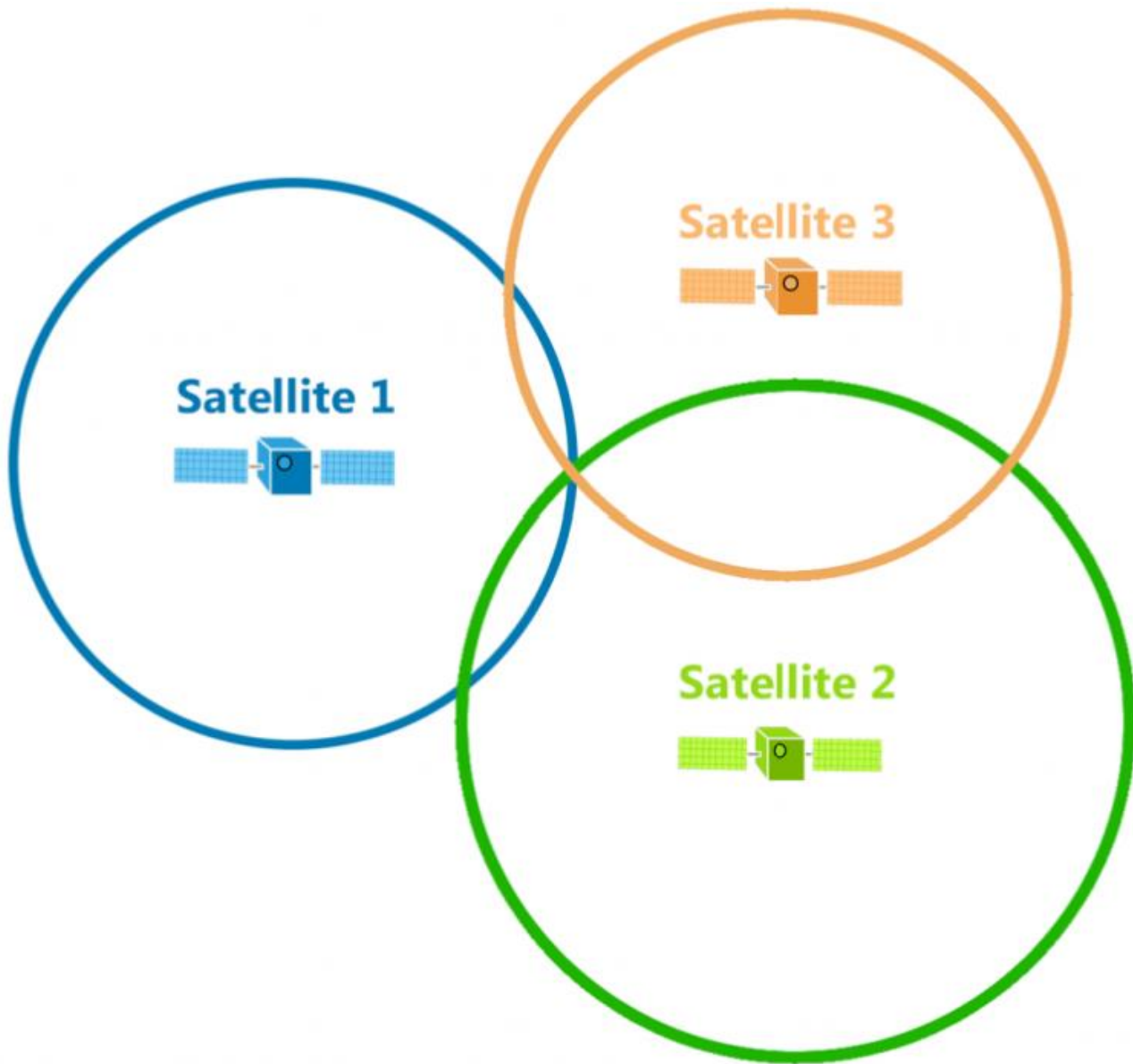
5. QZSS = Quasi-Zenith Satellite System (Japan only)



3. GLOBAL NAVIGATION SATELLITE SYSTEMs (GNSS) RECEIVER (continued)

Reference for the prior illustration:

https://www.researchgate.net/publication/282359540_Integrated_Cooperative_Localization_in_VANETs_for_GPS_Denied_Environments/link/560e65a508ae48337515f265/download



3. GLOBAL NAVIGATION SATELLITE SYSTEMs (GNSS) RECEIVER (continued)

Reference for the prior illustration:

<https://gisgeography.com/trilateration-triangulation-gps/>

3. GLOBAL NAVIGATION SATELLITE SYSTEMS (GNSS) RECEIVER (continued)

- Iphones use the all five of the previously-mentioned GNSSs simultaneously and automatically
- Android phones can use all five of the previously-mentioned GNSSs simultaneously and automatically

3. GLOBAL NAVIGATION SATELLITE SYSTEMS (GNSS) RECEIVER (continued)

- Most map apps for smart phones use the GNSS receiver as part of it's ability to locate where the phone is located

3. GLOBAL NAVIGATION SATELLITE SYSTEMs (GNSS) RECEIVER (continued)

- Specialized smart phone apps can use the GPS transmitter-receiver even if no data plan or Wi-Fi connection is available:

3. GLOBAL NAVIGATION SATELLITE SYSTEMS (GNSS) RECEIVER

(continued)

- "GPS Coordinates" app by gosur.com at
- https://play.google.com/store/apps/details?id=com.freemium.android.apps.gps.coordinates&hl=en_US&gl=US and
- <https://apps.apple.com/us/app/my-gps-coordinates/id1335952038>



3. GLOBAL NAVIGATION SATELLITE SYSTEMS (GNSS) RECEIVER (continued)

- "GPS Status & Toolbox" app by "MobiWIA Kft."

at

https://play.google.com/store/apps/developer?id=MobiWIA+Kft.&hl=en_US&gl=US

and

<https://apps.apple.com/bf/developer/mobiwia-kft/id1198499959>₅

3. GLOBAL NAVIGATION SATELLITE SYSTEMS (GNSS) RECEIVER (continued)

- "GPS Status & Toolbox" app by "MobiWIA Kft." (continued):

A

kft.

is a limited liability company that is located in Hungary



GPS Status & Toolbox

MobiWIA Kft.

4.3 ★

3. GLOBAL NAVIGATION SATELLITE SYSTEMS (GNSS) RECEIVER (continued)

- "GPS Status & Toolbox" app by "MobiWIA Kft." (continued):

The Android app (at

https://play.google.com/store/apps/developer?id=MobiWIA+Kft.&hl=en_US&gl=US)

defaults to the less-popular "degrees-minutes-seconds format for latitude and longitude but you can set it to default to the more popular "decimal degrees" format (which we recommend): 58

3. GLOBAL NAVIGATION SATELLITE SYSTEMS (GNSS) RECEIVER (continued)

- "GPS Status & Toolbox" app by "MobiWIA Kft." (continued):

To switch the Android app to default to the more popular "decimal degrees" format :
Start the "GPS Status.." app.

Tap anywhere--> Tap on the hamburger sandwich icon in the upper left corner
--> tap on "Settings"--> tap on "Units & Formatting"--> tap on "Location format"
--> tap on the top-most option

3. GLOBAL NAVIGATION SATELLITE

SYSTEMS (GNSS) RECEIVER (continued)

- "GPS Status & Toolbox" app by "MobiWIA

Kft." (continued):

Their iPhone app (at

<https://apps.apple.com/bf/developer/mobiwia-kft/id1198499959>)

defaults to the more-popular

"decimal degrees" format for latitude and longitude and you can toggle between the two formats by tapping on either the latitude or longitude value which is very helpful in an emergency situation!

3. GLOBAL NAVIGATION SATELLITE SYSTEMs (GNSS) RECEIVER

(continued)

- "My GPS Coordinates" app by "TappiApps" for iPhones at <https://apps.apple.com/us/app/my-gps-coordinates/id945482414> ("TappiApps" does not have a comparable app for Android cell phones.)



3. GLOBAL NAVIGATION SATELLITE SYSTEMS (GNSS) RECEIVER (continued)

- To test a GPS-only app:
Turn off the data plan in "Settings".
Turn off the Wi-Fi connection in "Settings".
Run the GPS-only app and see if it gets a correct GPS fix on your location.

3. GLOBAL NAVIGATION SATELLITE SYSTEMS (GNSS) RECEIVER (continued)

- For advice on using the GPS receiver in a cell phone for activities such as backpacking and when Wi-Fi location is not available, see

<https://www.cleverhiker.com/blog/how-to-use-your-phone-as-a-gps-device-for-backpacking>

and

<https://toomanyadapters.com/find-way-without-internet-connection/>

4. BLUETOOTH TRANSCEIVER

- According to <https://en.wikipedia.org/wiki/Bluetooth> **Bluetooth** is a wireless technology standard for exchanging data between fixed and mobile devices over short distances using Ultra High Frequency radio waves in the industrial, scientific and medical radio bands, from 2.400 to 2.485 GHz..

4. BLUETOOTH TRANSCEIVER (continued)

- Note that Bluetooth runs at the same radio frequencies as microwave ovens, cordless phones, and the original and still-in-use 2.45 Ghz frequency band of Wi-Fi systems.

4. BLUETOOTH TRANSCEIVER

(continued)

- Uses of Bluetooth transceiver inside smart cell phones:
 - Hands-free cell phone use in cars
 - "Personal Area Network" with computers, tablets, and printers, and
 - Micro-Location iBeacons
- Most Bluetooth apps in cell phones do not require a data plan or a Wi-Fi connection

4. BLUETOOTH TRANSCEIVER (continued)

- Uses of Bluetooth transceiver inside smart cell phones (continued):
Can be used to tether "data plan" Internet access to other devices if "Personal Hotspot" is turned on

4. BLUETOOTH TRANSCEIVER (continued)

- Bluetooth tracking devices:
"AirTag", "Tile", "Samsung Galaxy SmartTag", "Chipolo", etc.

See

<https://history-computer.com/airtag-vs-smarttag-vs-tile-vs-chipolo/>

and

<https://www.tomsguide.com/us/best-key-finders,review-2657.html>

5. NEAR-FIELD COMMUNICATION (NFC) TRANSCIVER

- According to

https://en.wikipedia.org/wiki/Near-field_communication

NFC is a set of short-range wireless technologies, typically requiring a separation of 10 cm or less (4 inches)

NFC operates at 13.56 MHz on ISO/IEC 18000-3 air interface and at rates

ranging from 106 kbit/s to 424 kbit/s.

(3 to 30 MHz is the "High Frequency" "shortwave radio" range.)

5. NEAR-FIELD COMMUNICATION (NFC)

TRANSCEIVER (continued)

- To use NFC with "Android Pay" or "Apple Pay"

Start "Android Pay" in an Android phone or "Wallet" in an iPhone or the store-specific app.

Place the top of the smart cell phone within 1 1/2-inches of the point-of-sale terminal device.

Follow the instructions in the wallet app or the store-specific app to complete the transaction.

5. NEAR-FIELD COMMUNICATION (NFC) TRANSCIVER (continued)

- Most wallet apps or store-specific apps do not require a data plan or a Wi-Fi connection when you are making a purchase at a "point of sale". They only require a NFC radio-transmitter chip for you to make a purchase at a "point of sale" terminal.. Many cheap Android phones do not have an NFC radio-transmitter chip.

5. NEAR-FIELD COMMUNICATION (NFC) TRANSCIVER (continued)

- iPhones prior to "iPhone 6" do not support "Apple Pay".

See

<https://www.macrumors.com/roundup/apple-pay/>

6. "ULTRA-WIDE BAND" (UWB)

- See <https://en.wikipedia.org/wiki/Ultra-wideband>
- Digital car keys from some car manufacturers
- Location pinpointing for some Bluetooth tracking devices

6. "ULTRA-WIDE BAND" (UWB) (continued)

- <https://www.pocket-lint.com/gadgets/news/156470-what-is-ultra-wideband-and-what-does-uwbd-do>
- <https://www.kbb.com/car-advice/vehicles-using-digital-keys/>

SENSORS IN A SMART CELL PHONE

- Magnetometer, etc.
- <https://fossbytes.com/which-smartphone-sensors-how-work/>
- <https://www.makeuseof.com/what-is-a-smartphones-sensor/>
- <https://medium.com/jay-tillu/mobile-sensors-the-components-that-make-our-smartphones-smarter-4174a7a2bfc3>

SENSORS IN A SMART CELL PHONE

(continued)

- <https://www.metaldetector.com/learn/buying-guide-articles/research/best-metal-detector-apps-for-iphone-android>
- <https://winerrorfixer.com/metal-detecting-apps/>

BASIC USES FOR A CELL PHONE

1. Telephone calls
2. Texting
3. Camera
4. Maps via apps
5. Internet access (for itself or other devices)
6. Digital wallet
7. Store and edit files and photos

BASIC USES FOR A CELL PHONE

(continued)

- Details of 1. Telephone calls:
Route through Cellular Transmitter/Receiver when no Wi-fi is available
Route through your Wi-Fi connection if you allow it in settings AND when a fast-enough Wi-Fi connection is available AND if the phone has a Wi-Fi transmitter/receiver

BASIC USES FOR A CELL PHONE

- Details of 2. Texting:
"Short Message Service" (= "SMS")
Messages do not travel over the Public
Switched Telephone Network (PSTN)
160 characters per message
Route through the cellular
transmitter/receiver of your cell phone

BASIC USES FOR A CELL PHONE

- Details of 2. Texting (continued):

See

<https://www.twilio.com/docs/glossary/what-sms-character-limit#:~:text=The%20character%20limit%20for%20a,are%20limited%20to%2067%20characters.>

BASIC USES FOR A CELL PHONE

- Details of 2. Texting (continued):
Texting does not travel through the "Public Switched Telephone Network":
Path of a text message from sender to recipient:

Cell phone

connects via radio waves to
cell tower (of carrier)

connects to

Base Station Controller ("BSC" of carrier)

connects to

Multiple Telephone Switching Office
("MTSO" of carrier)

connects to

Mobile Switching Center ("MSC" of carrier)

~~connects to~~

~~Public Switched Telephone Network (PSTN)~~

BASIC USES OF A CELL PHONE

(continued)

Details of 2. Texting (continued):

Path of a text message from sender to recipient:

The next slide uses only the cell system acronyms to save on space:

Cell phone
connects to
cell tower
connects to
"BSC"

connects to
"MTSC"

connects to
"MSC"

~~connects to~~
~~"PSTN"~~

BASIC USES OF A CELL PHONE (continued)

- Details of 2. Texting (continued):
Path of a text message from sender to recipient:
- When a cell phone sends a text message, they are routed to and between "Mobile Switching Centers" ("MSCs") that belong various cell phone carriers and the call is NOT routed through the "Public Switched Telephone Network":

Cell phone
connects to
cell tower
connects to
"BSC"

connects to
"MTSC"

connects to
"MSC"

~~connects to~~
~~"PSTN"~~

Cell phone
connects to
cell tower
connects to
"BSC"

connects to
"MTSC"

connects to
"MSC"

~~connects to~~
~~"PSTN"~~



BASIC USES FOR A CELL PHONE

- Details of 3. Camera(s):
Front-facing Camera
(for selfies and "Zoom", "Skype", and "Google Duo", has better foreground focus)
Rear Camera(s)
(sometimes called the "Main Camera", has been infinity focus)

BASIC USES FOR A CELL PHONE

- Details of 4. Maps via apps:
Maps apps that rely on Wi-Fi location
Maps apps that work well with GPS
only

BASIC USES OF A CELL PHONE

- Details of 5. Internet access

All current smart phones can act as a provider of Internet access for both itself and other devices, with three ways to connect to the Internet: a "Data Plan" via Cellular Transceiver or "Wi-Fi" through "Wi-Fi Transceiver" or Wired "Ethernet" through an external Ethernet adapter

BASIC USES OF A CELL PHONE

- Details of 5. Internet access
(continued):

This "feature" is sometimes called "personal hotspot".

BASIC USES FOR A CELL PHONE

- Details of 6. Digital wallets:

See

http://aztcs.org/meeting_notes/winhardsig/cell-phones/cell-phone-wallet-apps.pdf

BASIC USES FOR A CELL PHONE

- Details of 7. Store and edit files and photos via apps:
"Google Photo", "Samsung Gallery",
"Amazon Photos", etc.

INTERNET CONNECTION IS MANDATORY FOR APP INSTALLATION

- Any smart phone app that does not require an Internet connection for normal operations (i.e. that does not require a Wi-Fi connection or a data plan) still will require an Internet connection when you are installing an app (for the first time) or when you are upgrading an app

THREE WAYS TO CONNECT A SMART CELL PHONE TO THE INTERNET

- Wi-Fi "Wireless Access Point"
- Data Plan (from your cellular carrier)
- Ethernet Adapter (to wired Internet)
 - Lightning-to-Ethernet adapter
for an iPhone
 - USB-C to Ethernet adapter
or micro USB to Ethernet adapter for
an "Android" cell phone

THREE WAYS TO CONNECT A SMART CELL PHONE TO THE INTERNET

- If you wish to connect your cell phone to a wired Ethernet connection to a existing Internet-connected router or a broadband modem, you can attach the cell phone to an Ethernet adapter which is an optional accessory that you have to buy

USE "SPEEDTEST.." TO DETERMINE IF YOU PHONE IS USING IT'S DATA PLAN OR YOUR HOME Wi-Fi

- When you are at home, your iPhone or Android phone will default to using your home Wi-Fi when it is fast and reliable enough. However, your iPhone or Android phone will use your cellular data plan instead if it detects that your home Wi-Fi is too slow or unstable.

USE "SPEEDTEST.." TO DETERMINE IF YOU PHONE IS USING IT'S DATA PLAN OR YOUR HOME Wi-Fi (continued)

- If you have a cellular data plan, make sure that it is turned off in "Settings". Then make sure that Wi-Fi is turned on in "Settings". Then use "Speedtest by Ookla" to determine your upload and download speeds.

USE "SPEEDTEST.." APP TO
DETERMINE IF YOUR PHONE IS USING
IT'S DATA PLAN OR YOUR HOME Wi-Fi
(continued)

- If you have a cellular data plan, make sure that it is turned on in "Settings". Then make sure that Wi-Fi is turned off in "Settings". Then use "Speedtest by Ookla" to determine your upload and download speeds.

USE "SPEEDTEST.." TO DETERMINE IF YOU PHONE IS USING IT'S DATA PLAN OR

YOUR HOME Wi-Fi (continued)

- If you have a cellular data plan, make sure that both Wi-Fi and "Cellular Data" are turned on in settings. Then use "Speedtest by Ookla" to determine your upload and download speeds. If your upload and download speeds indicate that you are using your cellular data plan, even when your home Wi-Fi is available, it usually means that you need to fix your home Wi-Fi.

APPENDIX 1: CELL PHONE GENERATIONS

- <https://encyclopedia2.thefreedictionary.com/cell+phone+generations>
- <https://www.pcmag.com/encyclopedia/term/cellular-generations>

