

African School on Space Science

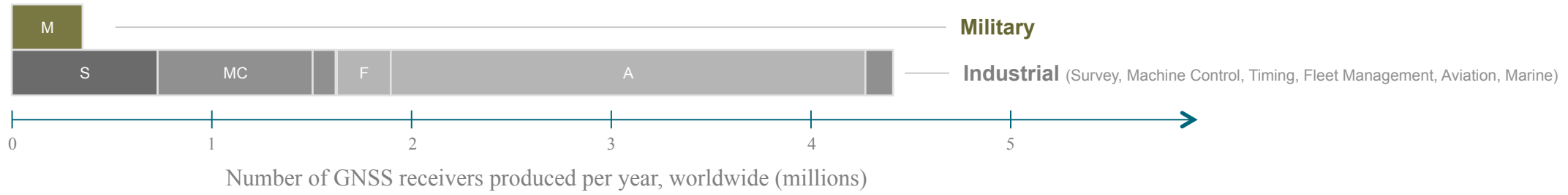
What's available today

Consumer GNSS, APIs and Apps

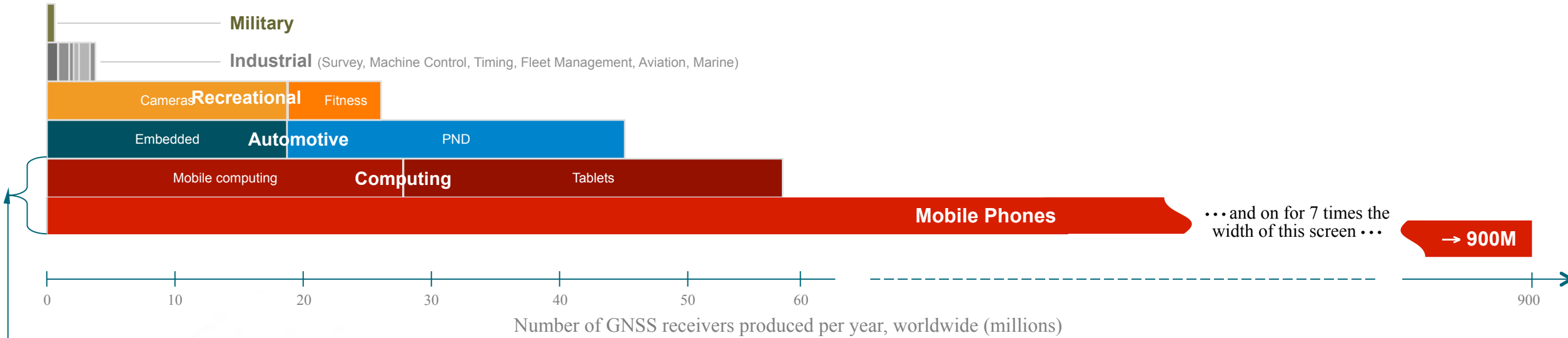
Frank van Diggelen

Broadcom Corporation, and Stanford University

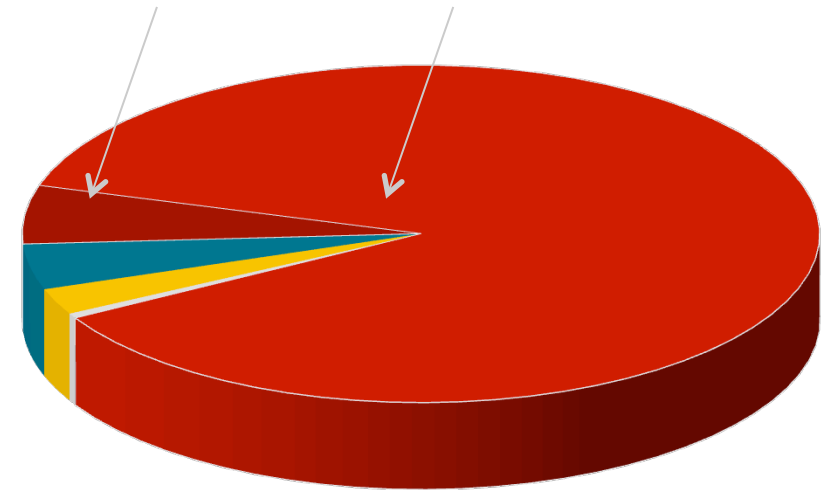
GNSS MARKET SIZE, 2012



GNSS MARKET SIZE, 2012



I'm focusing on these market segments: tablets, cell phones:

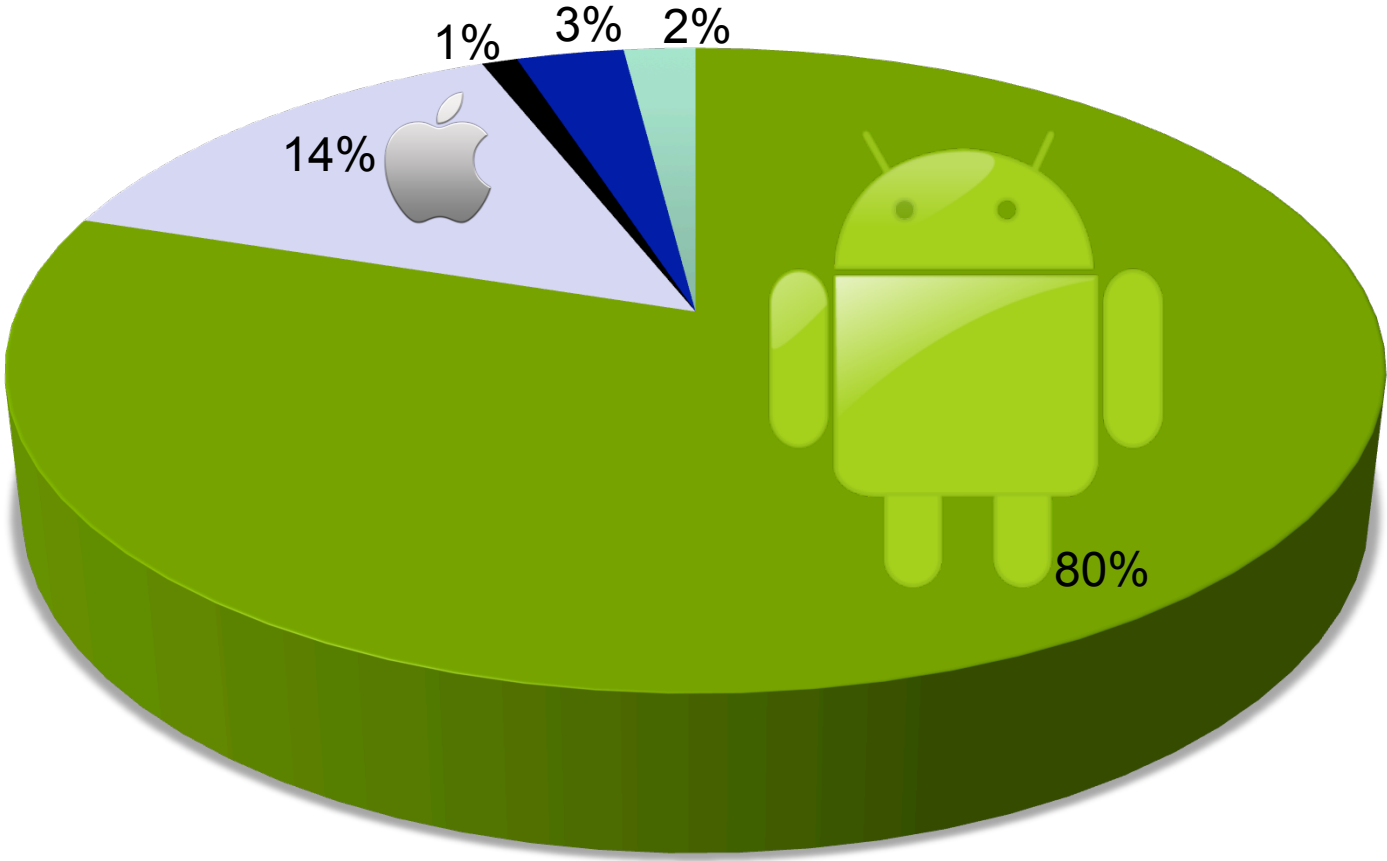


Available now, GNSS constellations



OS share of smartphones (2014)

■ Android ■ iOS ■ Blackberry ■ Windows phone ■ other



GNSS Data

Android



- time
- lat, lon, alt
- svid, c/n_0 , az, el

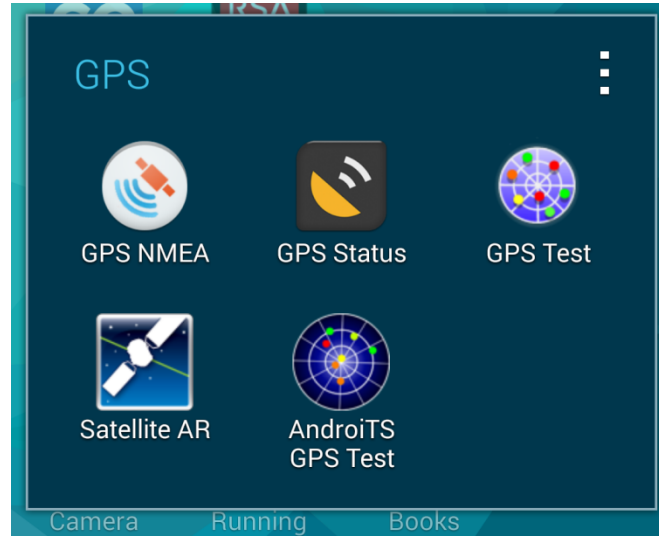
iOS



- time
- lat, lon, alt ← not necessarily GPS

Apps

Android



Android

iOS

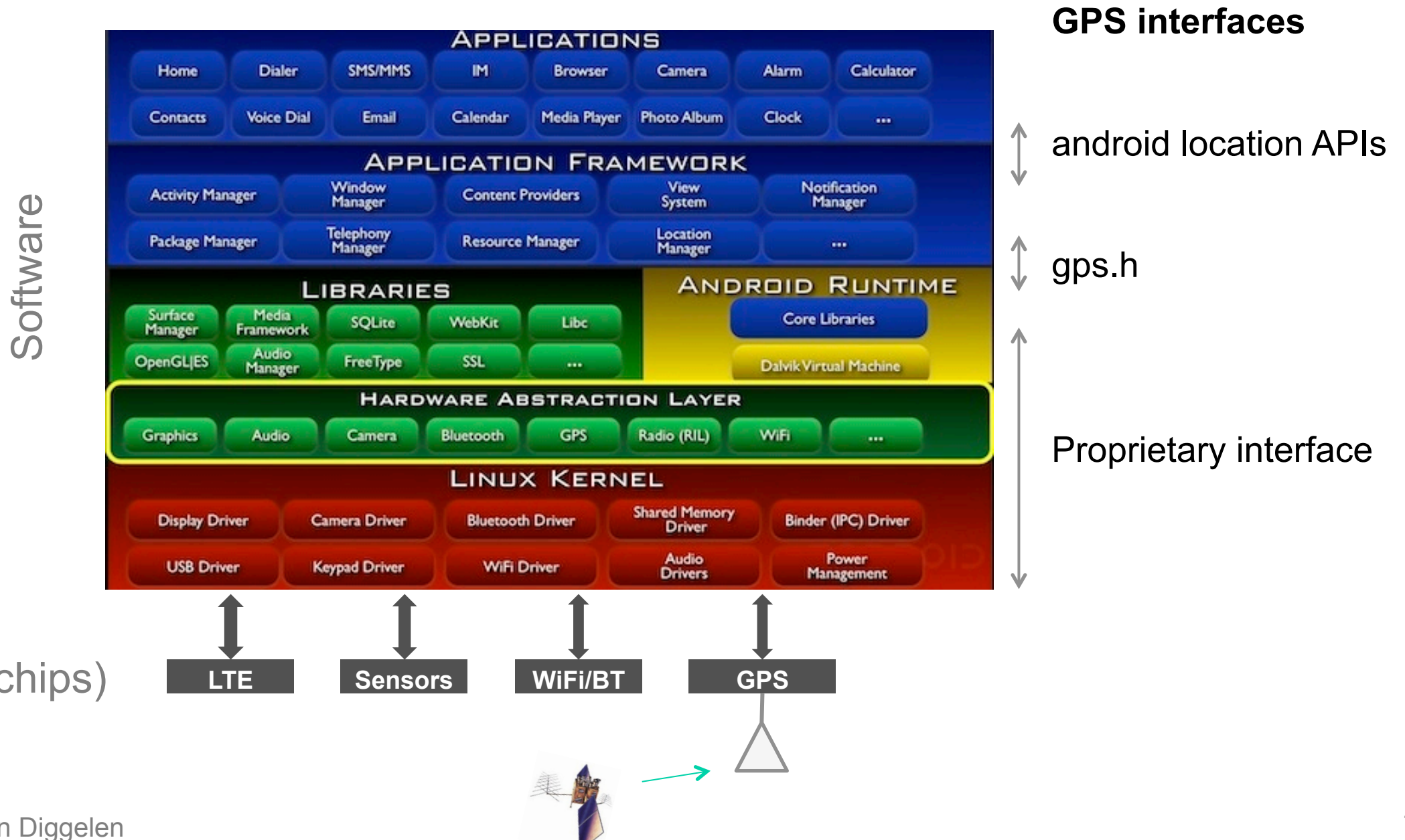


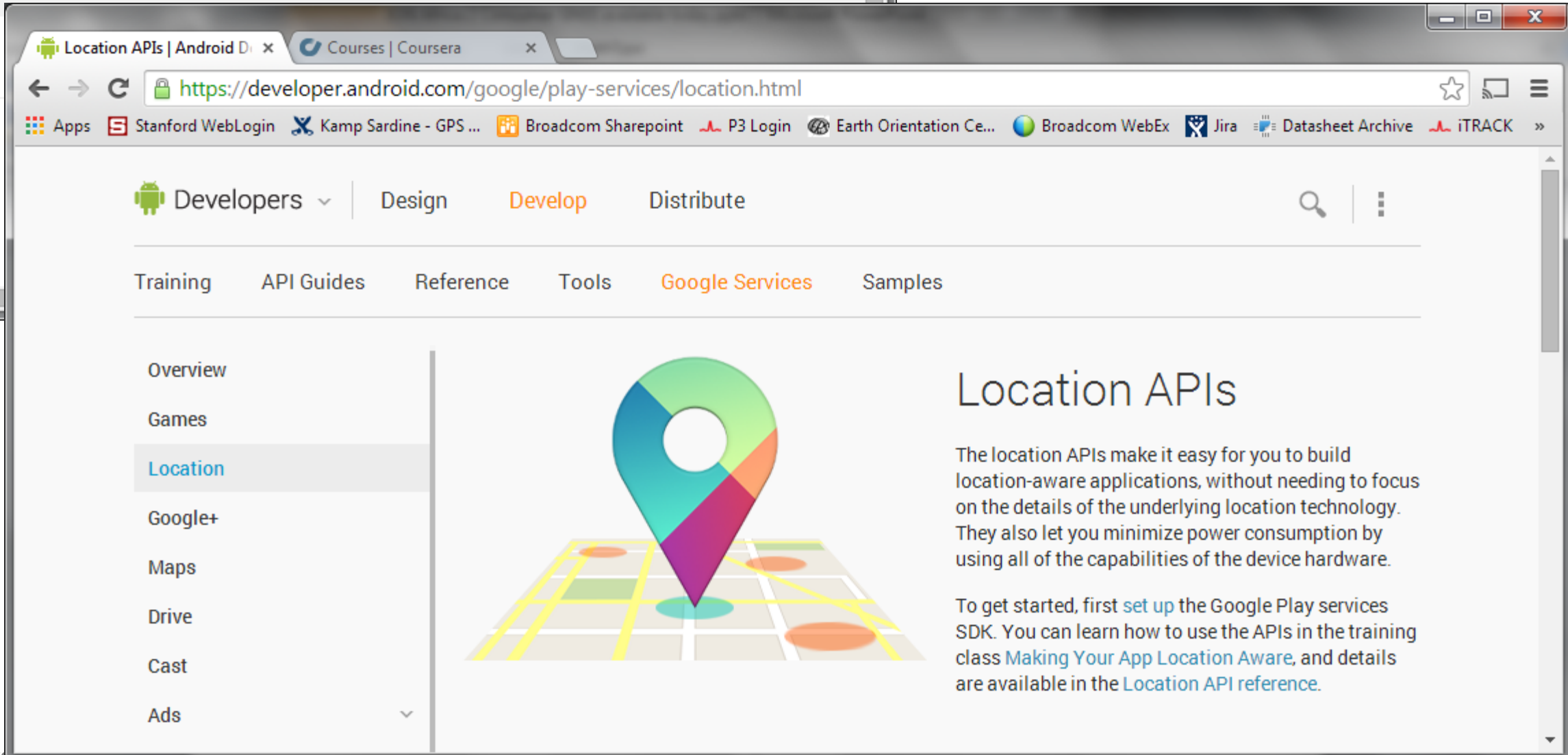
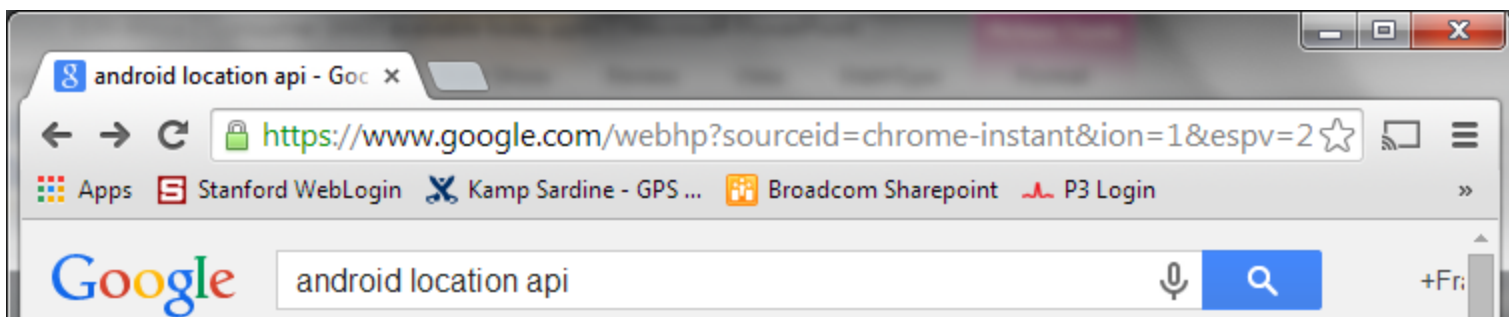
Which devices have GPS, GLONASS & BeiDou

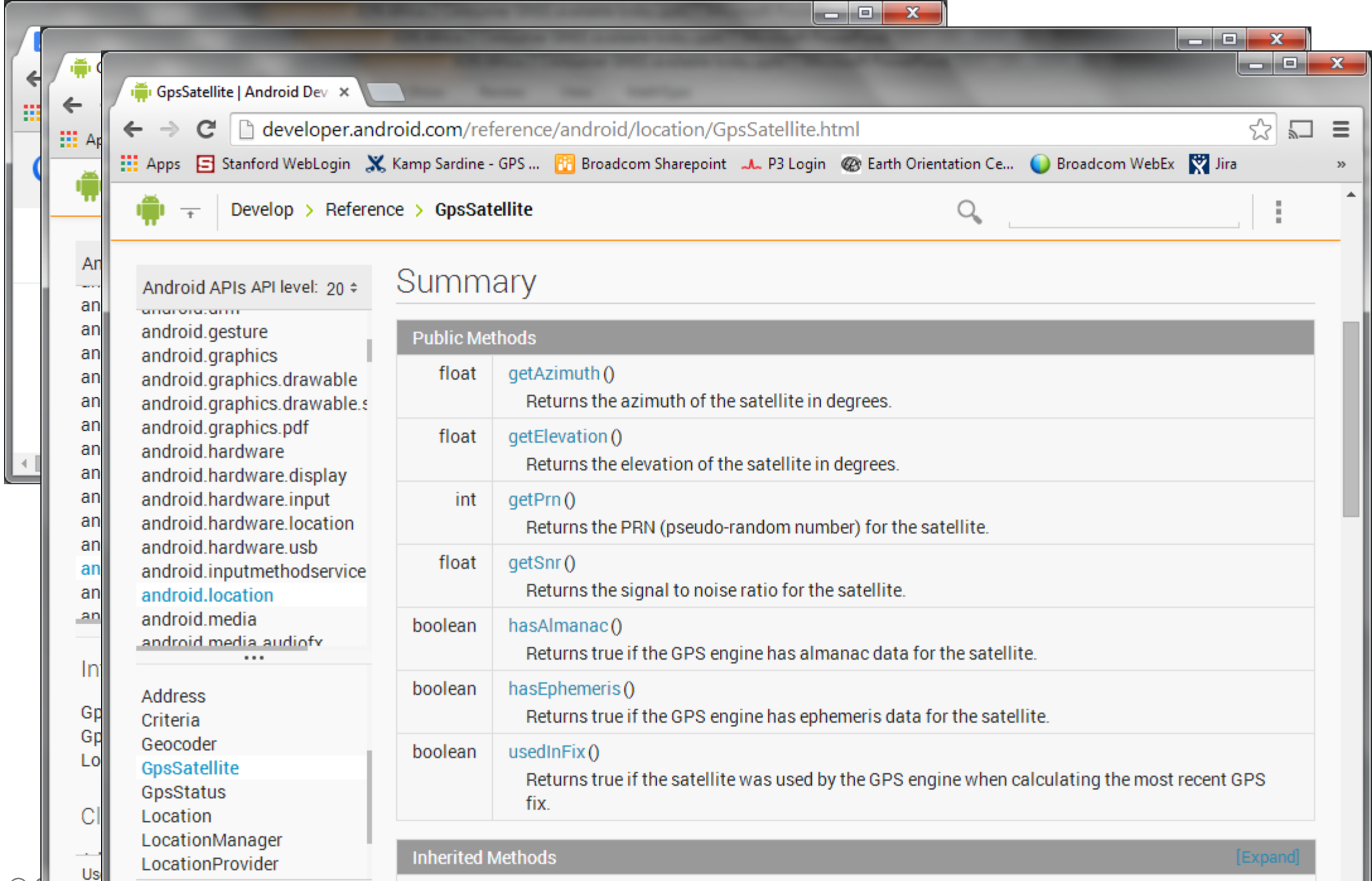


Specific example: getting C/No from a phone

The Android Software Stack, or “Framework”







Android APIs API level: 20

- android.os
- android.gesture
- android.graphics
- android.graphics.drawable
- android.graphics.drawable.s
- android.graphics.pdf
- android.hardware
- android.hardware.display
- android.hardware.input
- android.hardware.location
- android.hardware.usb
- android.inputmethodservice
- android.location**
- android.media
- android.media.audiofv
- ...

- Address
- Criteria
- Geocoder
- GpsSatellite**
- GpsStatus
- Location
- LocationManager
- LocationProvider

Summary

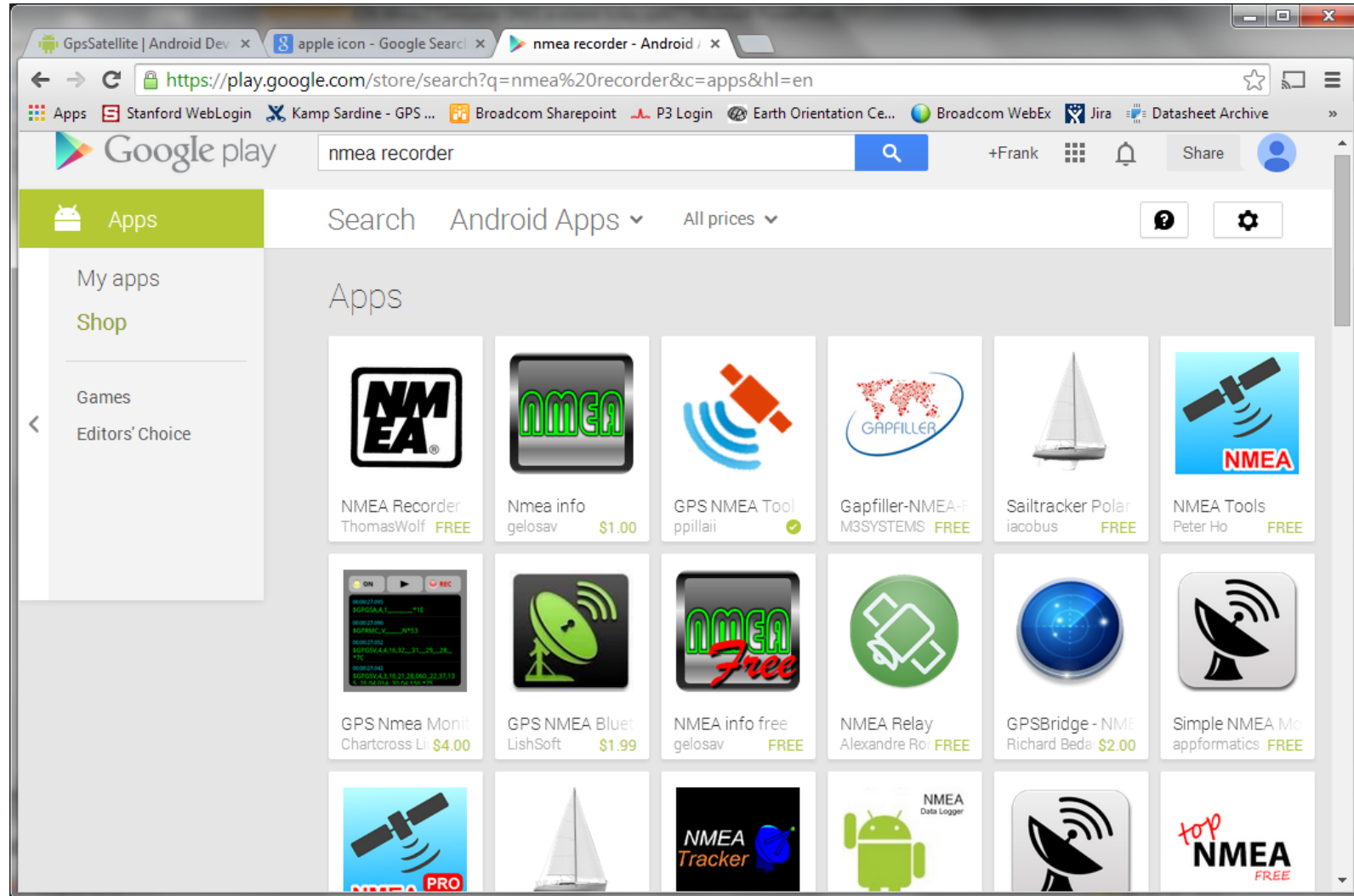
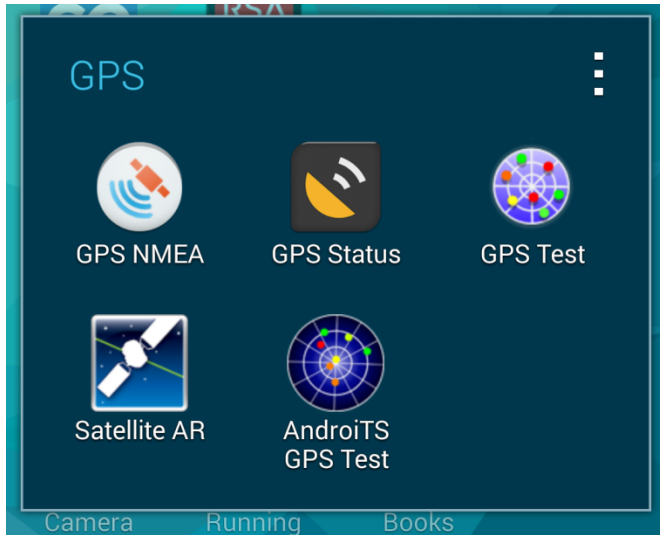
Public Methods

| | |
|---------|---|
| float | getAzimuth() Returns the azimuth of the satellite in degrees. |
| float | getElevation() Returns the elevation of the satellite in degrees. |
| int | getPrn() Returns the PRN (pseudo-random number) for the satellite. |
| float | getSnr() Returns the signal to noise ratio for the satellite. |
| boolean | hasAlmanac() Returns true if the GPS engine has almanac data for the satellite. |
| boolean | hasEphemeris() Returns true if the GPS engine has ephemeris data for the satellite. |
| boolean | usedInFix() Returns true if the satellite was used by the GPS engine when calculating the most recent GPS fix. |

Inherited Methods [\[Expand\]](#)

► From class [java.lang.Object](#)

Apps



RINEX? Not yet
NMEA Yes

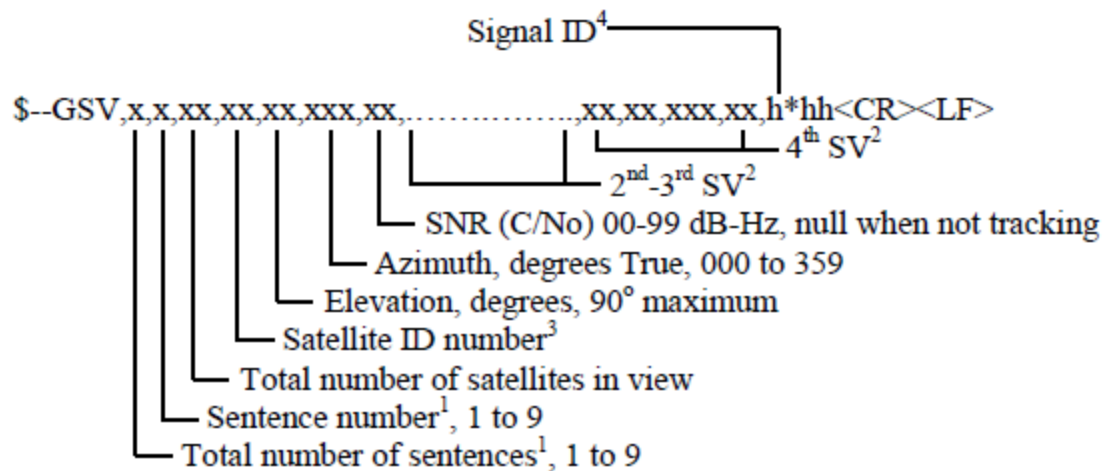
NMEA standard, GSV message

GSV – GNSS Satellites In View

The GSV sentence provides the number of satellites (SV) in view, satellite ID numbers, elevation, azimuth, and SNR value. The GSV sentence contains four satellites maximum per transmission. The total number of sentences being transmitted and the sentence number being transmitted are indicated in the first two fields.

If multiple GPS, GLONASS, Galileo, etc. satellites are in view, use separate GSV sentences with talker ID GP to show the GPS satellites in view and talker GL to show the GLONASS satellites in view and talker GA to show the Galileo satellites in view, etc. When more than ranging signal is used per satellite, also use separate GSV sentences with a Signal ID corresponding to the ranging signal.

The GN identifier shall not be used with this sentence.



,XX,

SNR (C/No) 00-99 dB-Hz, null when not tracking

Keith's questions

- C/N_0 available?
 - What resolution
 - How often?
 - Averaging period?
- Yes
 - float at api layer
integer dB-Hz in NMEA
 - 1 Hz
 - 1 s down to 200 ms

Our first cell-phone scintillation measurement