

Pengantar (Inovasi) Aplikasi Bergerak

LBS
GPS

LOCATION BASED SERVICE

- *Location Based Service* (LBS) merupakan layanan yang menyediakan informasi spatial kepada pengguna dengan berbasis pada lokasi geografis.
- Metode yang umum digunakan pada teknik ini adalah
  - *Cell of Origin* (CoO),
  - *Time Difference of Arrival (TDoA)*,
  - *Angle of Arrival* (AoA) dan
  - *Enhanced Observed Time Difference* (E-OTD)

Metode LBS

- **Metode CoO (*Cell of Origin*)**

  Merupakan metode yang paling sederhana, yaitu menggunakan informasi lokasi dari BTS. Metode ini jarang digunakan karena akurasinya yang rendah.

- **Metode TDoA (*Time Difference of Arrival)***

  Merupakan metode yang umum digunakan karena akurasi yang dihasilkan cukup tinggi. Metode ini menggunakan perhitungan perbedaan waktu dari minimal tiga BTS yang terdekat.

Metode LBS

- **Metode AoA (*Angle of Arrival)***

  menggunakan perhitungan dari sudut dimana sinyal ditransmisikan dan ditangkap oleh BTS.

- **Metode E-OTD (*Enhanced Observed Time Difference)***

  menggunakan perhitungan yang hampir sama dengan metode TDoA. Kedua sisi yaitu BTS dan perangkat pengguna (ditambahkan aplikasi tertentu) digunakan untuk menghitung perbedaan waktu antara BTS. Estimasi posisi dihitung berdasarkan perbedaan waktu dari minimal tiga BTS yang terdekat dengan menggunakan teknik posisi hiperbola. Teknik E-OTD dapat menghasilkan akurasi yang lebih tinggi yaitu 50 – 125m.

GPS

- Selain teknik non-GPS yang berbasiskan jaringan, penentuan lokasi untuk aplikasi LBS dapat juga dilakukan dengan teknik GPS (*GPS/A-GPS based* atau *handset based*).
- GPS adalah teknologi navigasi yang memanfaatkan satelit. Penerima GPS memperoleh sinyal dari beberapa satelit yang mengorbit bumi. Satelit yang mengitari bumi pada orbit pendek ini terdiri dari 24 susunan satelit, dengan 21 satelit aktif dan 3 buah satelit sebagai cadangan. Dengan susunan orbit tertentu, maka satelit GPS dapat diterima di seluruh permukaan bumi.
- GPS dapat memberikan informasi posisi dan waktu dengan ketelitian sangat tinggi.

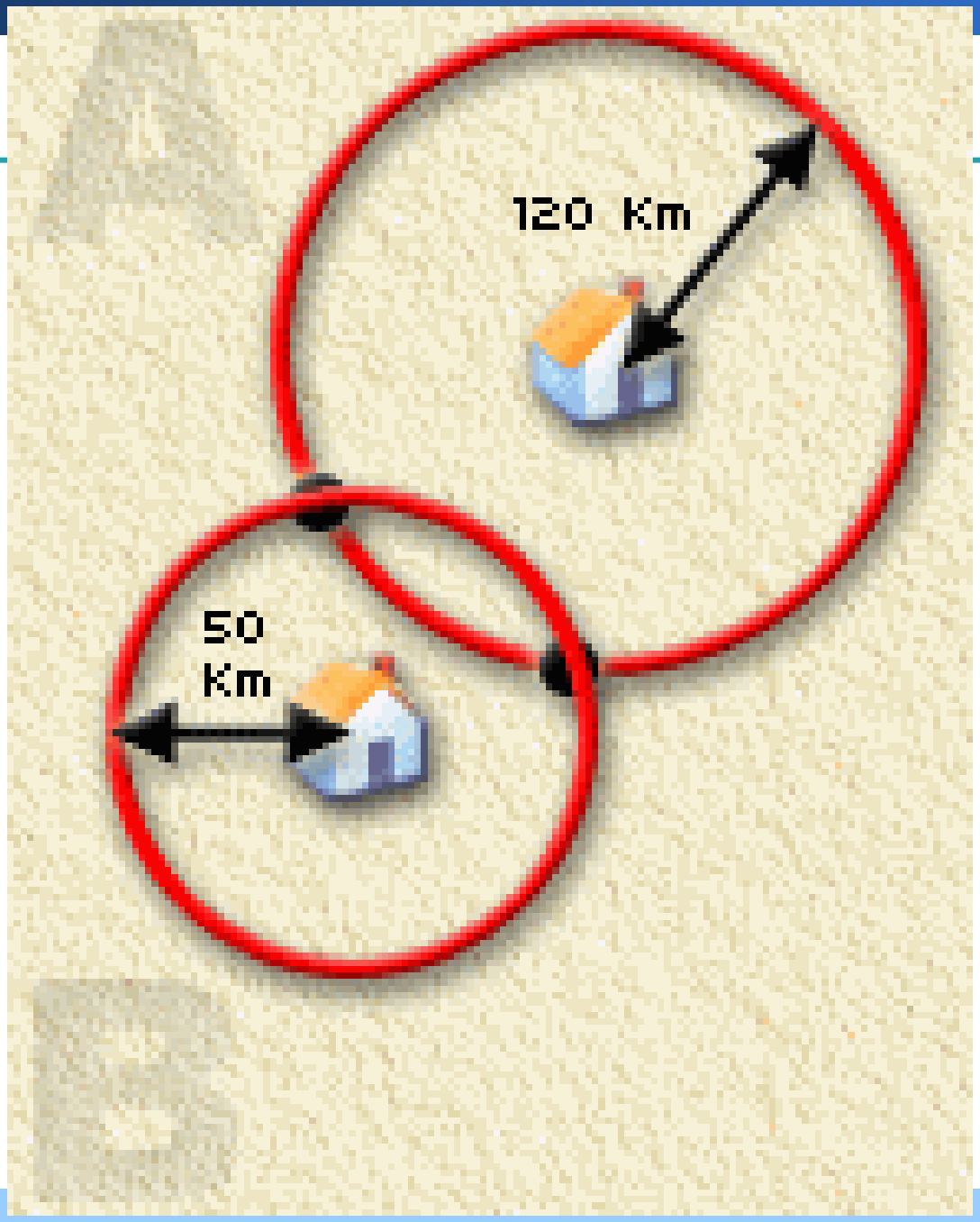
2D Trilateration

- GPS positioning is based on trilateration. Trilateration is basically, calculating your position based on the distances to at least three known positions.
- As an example, let's say that you are somewhere in Europe and you are lost -- you don't have a clue where you are. However, you know that the distance to city A is 120 Km.

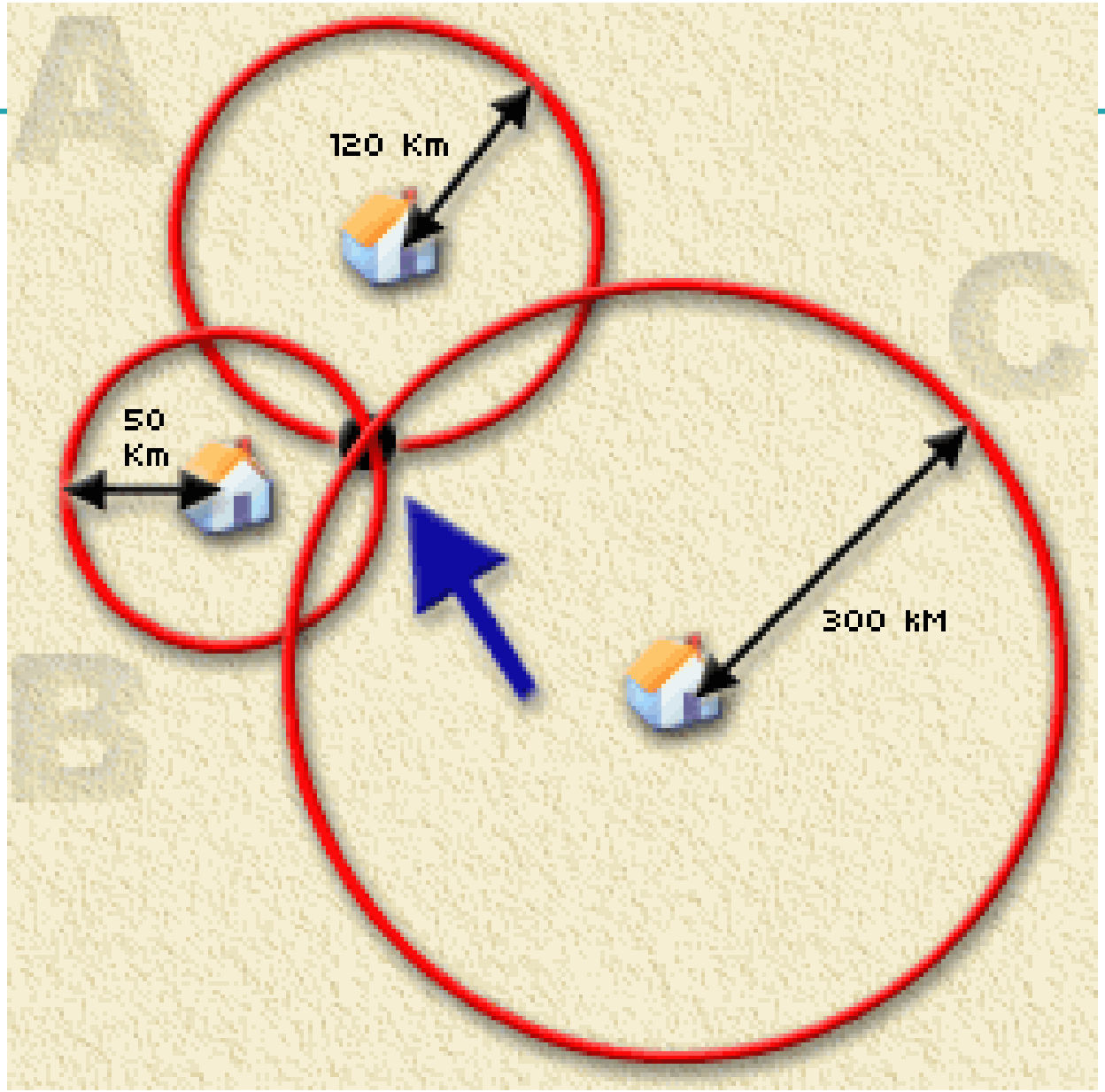
  This is pretty useless in itself. You still don't know if you positioned in the North or South of that city.
- Draw a circle on the map, with a radiums of 120 Km and you'll know that you're somewhere on that line (red line in the drawing below).

ilustrasi

- Let's say you also know that you're 50 Km of city B, and you draw another circle on the map, using City B as the centre and having a radius of 50 Km, then you know that you will be on either of the points that intersect with circle A.
- These point are indicated as black dots in the drwaing below.


120 Km
50
Km

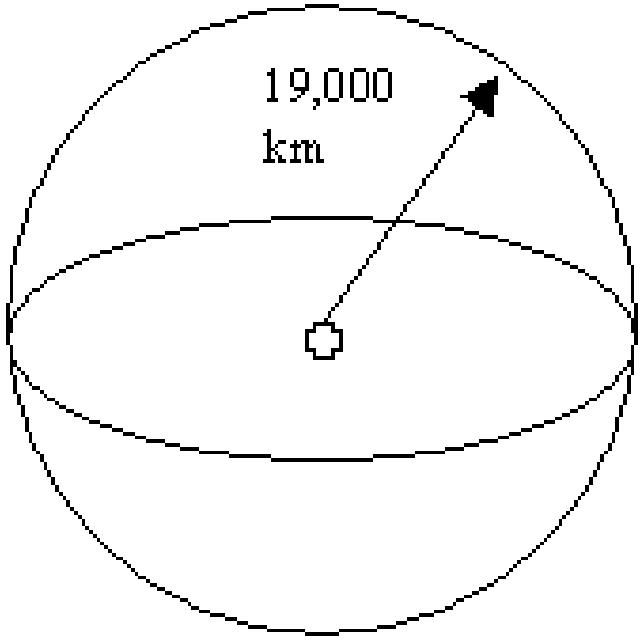
- the collection of possible locations is reduced from infinite (the circle) to only 2 locations.
- Suppose you also know that the disctance to city C would be 300 Km and you draw circle C (city C as the centre and the radius equal to 300 Km), then only one valid intersection will remain. Your exact position (blue arrow in the drawing below indicates where you must be standing!


120 Km
50
Km
300 kM

- Sound pretty simple doesn't it? This 2D concept is being used with GPS - pretty smart thinking eh?
- Combine this - for GPS - with a 4th location, and imagine the circles being sphere's (we're going 3D now), then you will have altitude as well. The point where all 4 spheres intersect.
- **How is it done in with satellites?**
- For a GPS receiver to find your location, it has to determine two things:
- Exact location of at least 3 GPS-satellites.
- The distance between you and each of these satellites.

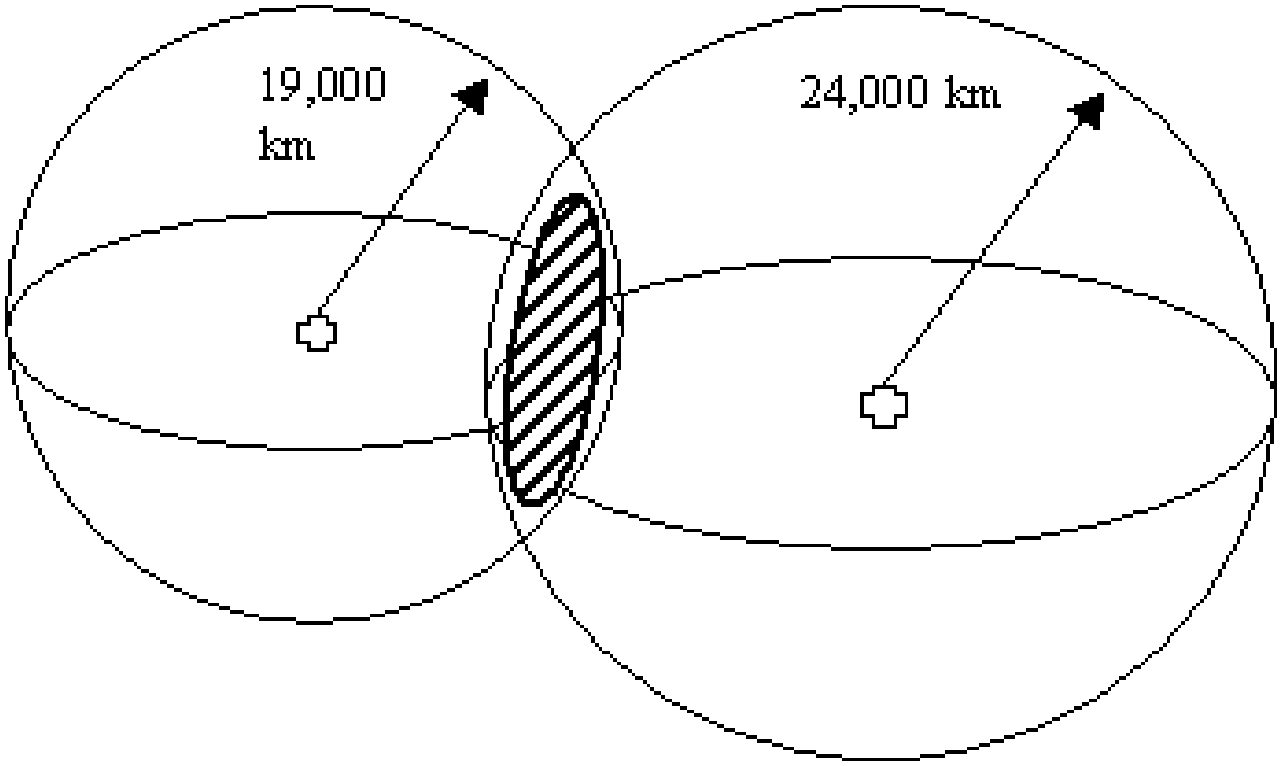
GPS Trilateration

- Trilateration- a position is calculated by knowing the location of, and measuring the distance to a group of satellites.

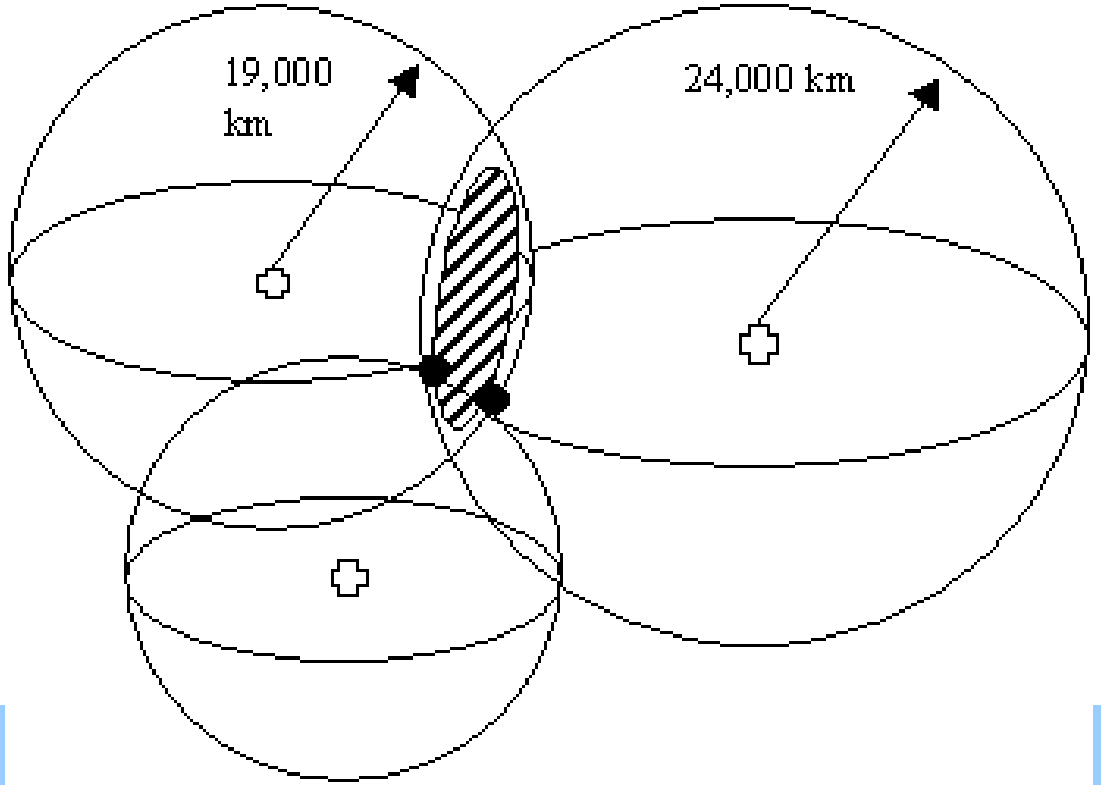


We are somewhere on the surface of this sphere.
A second measure narrows it down to the intersection of two spheres.

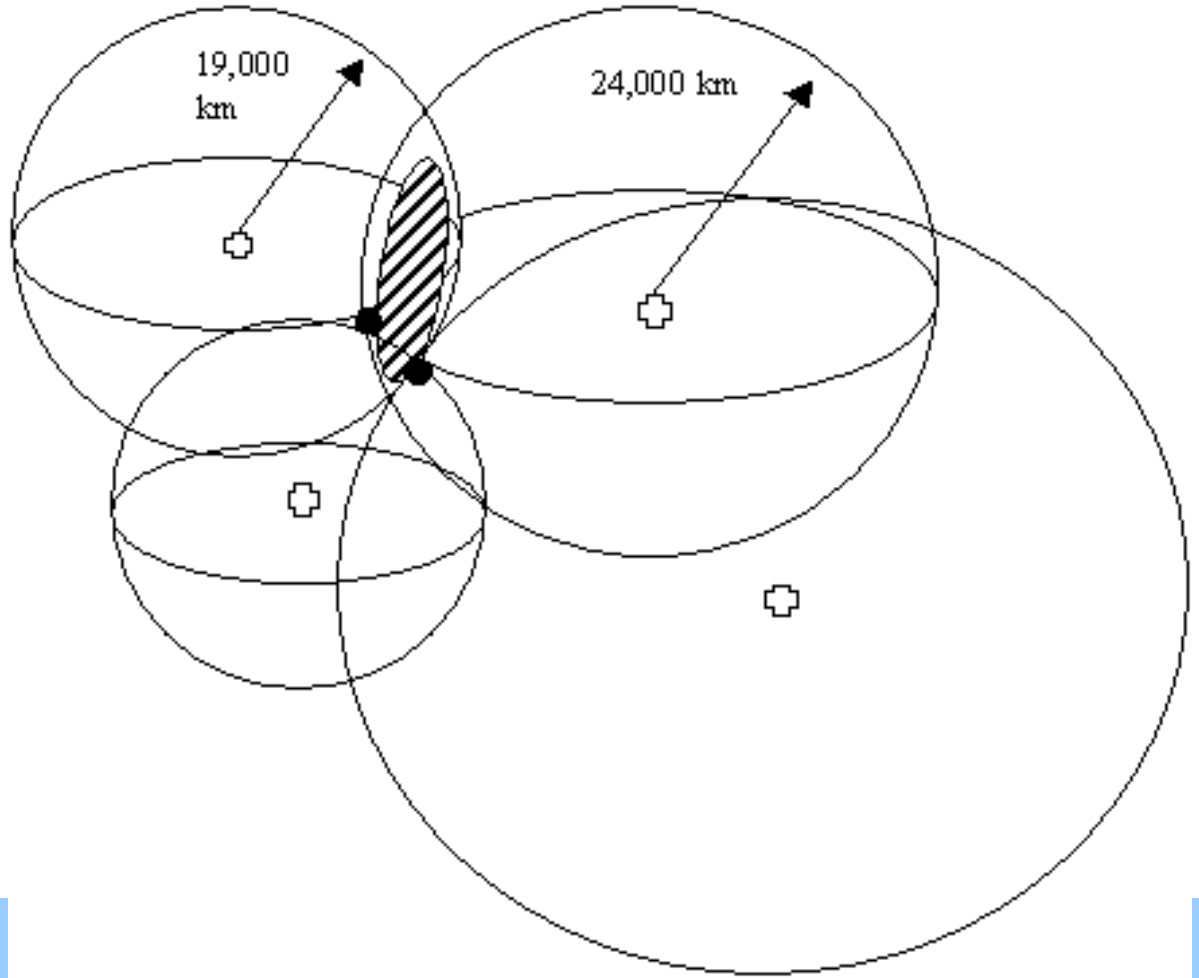
- The intersection of two spheres is a circle, so you are now located on the perimeter of the circle.



- A third measurement narrows it down to just two points.
- The intersection of three spheres is two points.



- A fourth point decides between the two points



GPS Indoor and Outdoor

How GPS Works

ENCODED SIGNAL

SATELLITE POSITION DATA STREAM

The satellite tells you where it is, not vice versa. The GPS receiver works out where it is by combining the satellite position data with the time of arrival of the encoded signal. The encoded signal carries a known code that repeats itself identically every millisecond. The GPS receiver measures the time of arrival of this code to a fraction of a millisecond, and thus determines the distance to the satellite.

How GPS Works Indoors

Both the data stream and encoded signal get weaker when they pass through buildings. But the encoded signal repeats itself identically every millisecond, so with the right hardware, a GPS receiver can accumulate thousands of copies in seconds, thus detecting satellite signals up to a thousand times weaker than outdoors.

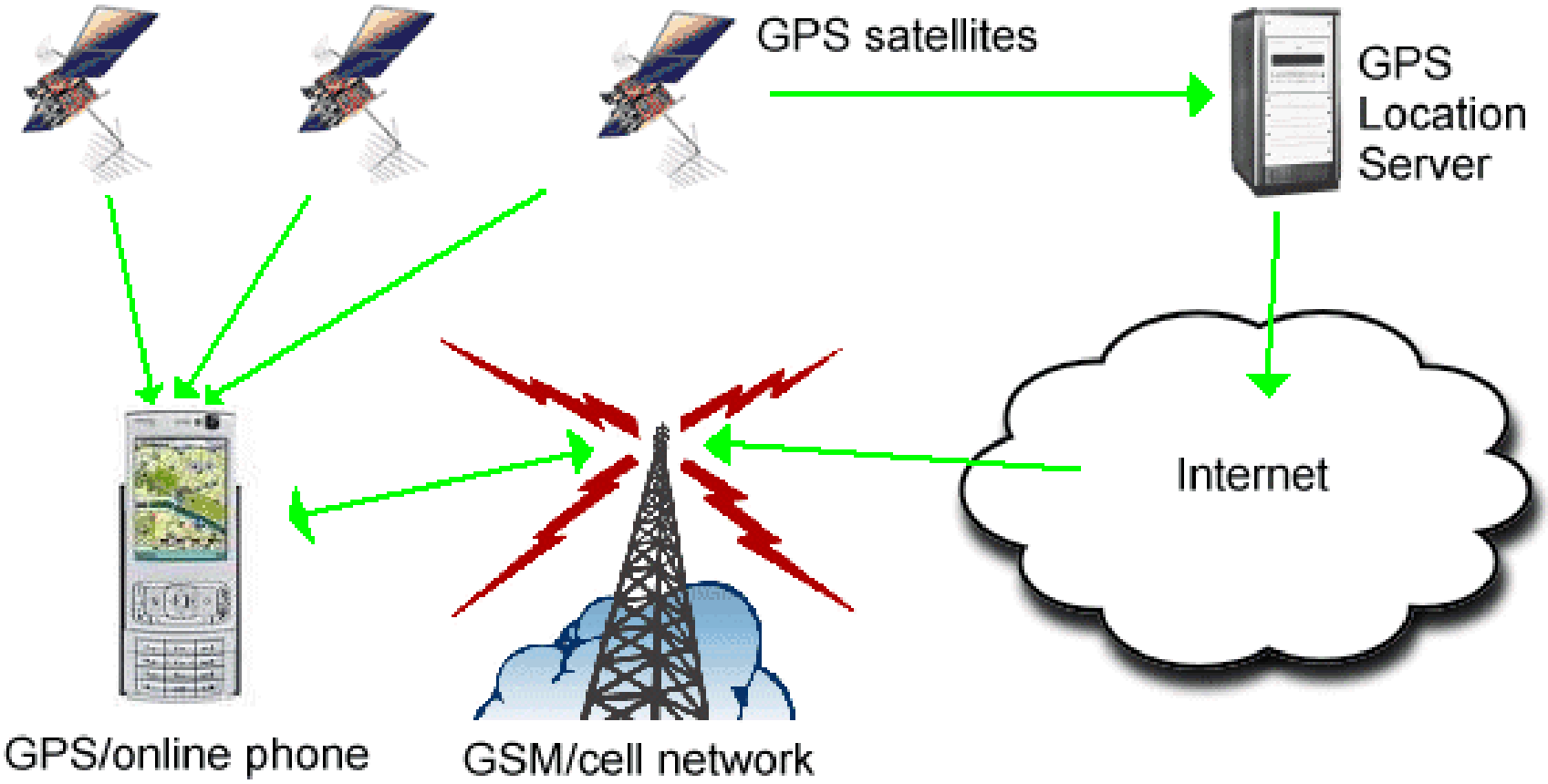
GPS dan A-GPS

Limitasi receiver GPS standar adalah sebagai berikut :

- Receiver GPS standar membutuhkan waktu yang relatif lebih lama (beberapa menit) untuk mendownload data dari satelit sebelum melakukan komputasi posisi.
- Receiver GPS standar sulit menginterpretasi sinyal yang lemah dari satelit ktika berada di dalam gedung(indoor) atau di daerah perkotaan yang memiliki banyak gedung tinggi.

GPS dan A-GPS

- Assisted-GPS (A-GPS) dikembangkan untuk memperbaiki performasi receiver GPS dengan menyediakan data yang biasanya harus didownload dari satelit GPS.
- Data ini diperoleh receiver GPS dari server A-GPS melalui base station.


GPS satellites
GPS
Location
Server
Internet
GPS/online phone
GSM/cell network

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- http://www.weethet.nl/english/gps_howitworks.php
- http://www.allaboutsymbian.com/features/item/The_future_of_GPS-equipped_smartphones.php