



# Personal Computer Geolocation System



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## Personal Computer Geolocation System (PCGS)

- PCGS is a Radio Frequency(RF) Geolocation system capable of precise estimation of a transmitter's position using multiple (i.e., 3 or 4) time-synchronized “monitoring sites” which are connected together logically over a Local, Wide Area, or Internet network.
- Emitter location is performed by making Time Difference of Arrival (TDOA) measurements on the signals arriving at the monitoring sites.
- A “System” consists of one or more “Client” or “Base Station” node and 3 or more “Remote” nodes

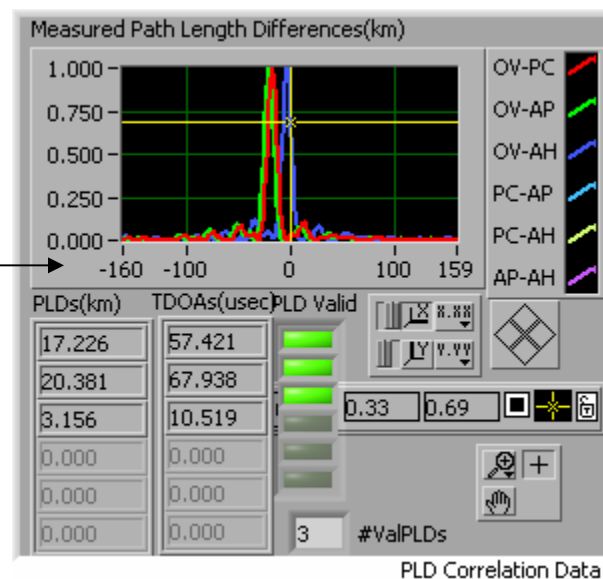
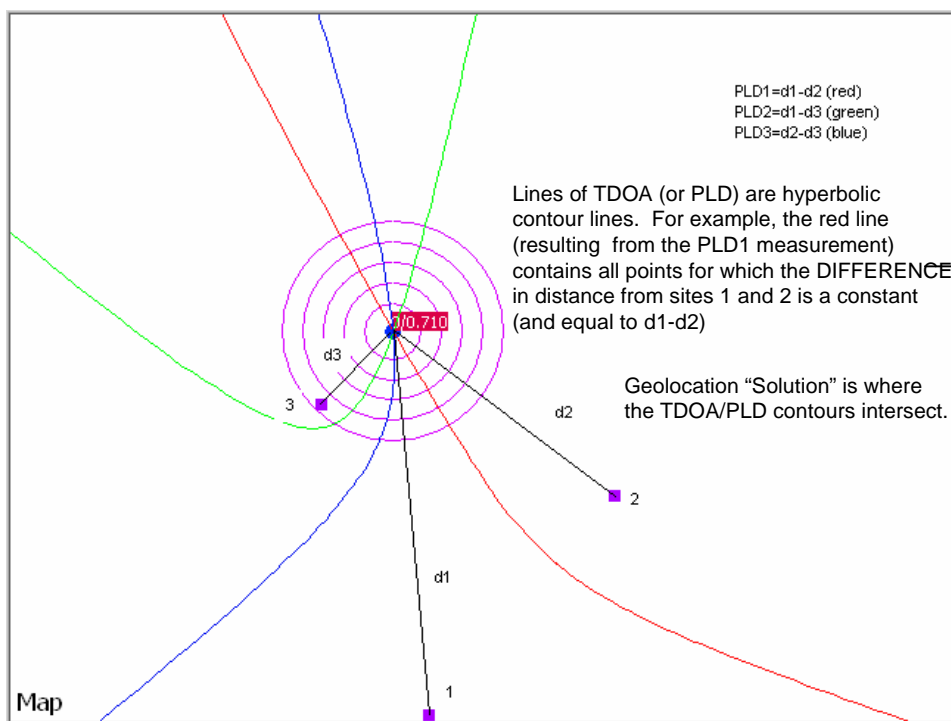


# Basic TDOA System Geolocation Concepts

- Basic operating principles
  - Listen/sample RF signal simultaneously from multiple (3 or 4) time-synchronized sites
  - Perform pair-wise cross-correlation of data sets from each site to determine differences in time delays in signal paths from emitter to each site
  - Calculate/Plot hyperbolic “contour lines” resulting from TDOA measurements
  - Estimate transmitter geolocation from intersection point(s) of contour lines
- Note that TDOA cannot be measured on pure/unmodulated RF carrier. Very narrow-bandwidth signals difficult to locate with TDOA

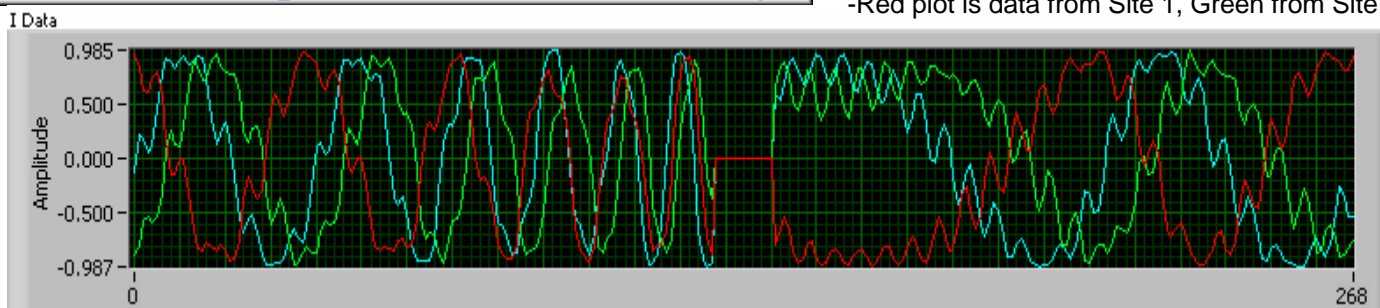


# TDOA System Geolocation Concept



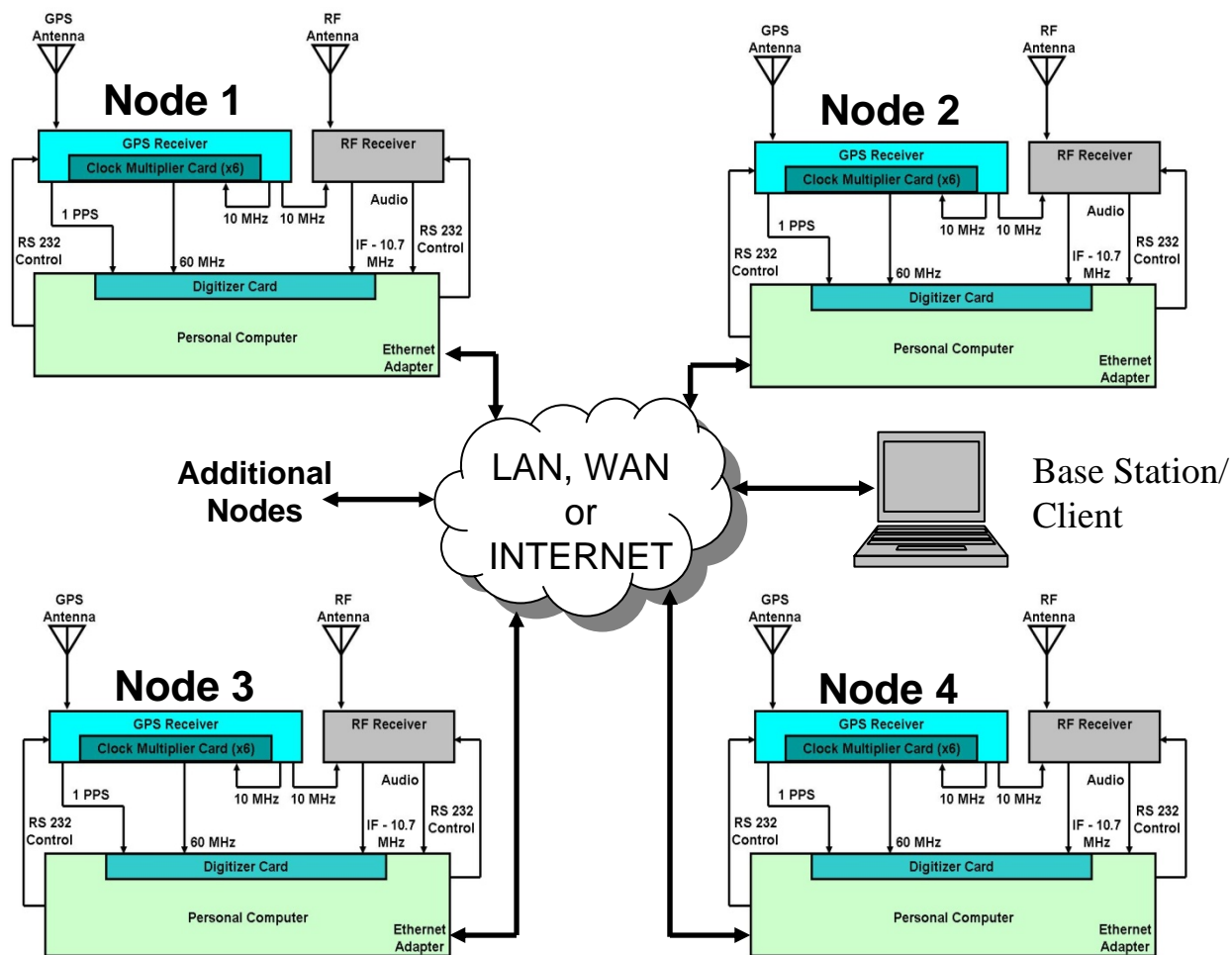
Raw Signal Data (Time Domain)

-Red plot is data from Site 1, Green from Site 2, and Blue from 3





# System High-Level Architecture





# 'Geoloc' Panel

PCGS Client V1.1

File Edit Operate Tools Window Help

Config Radio Cntrl Geoloc Site Status/Monitor

STOP Connection Status Site Sync Status LOMA OTAY PEND SANC  
GPS TOD's 25829 25830 25830 25829

07:10:29 Current UTC Time 2008/04/22 CollectTime 25699

Map View SDU/CorrPlot Geoloc Cntrl OTH-G Reports SiteDataRcv'd PLDs Valid

AUDIO: Vol Site Select MixEn Audio Playback Enable Audio Recording

**GeoLocData**

N	Date & Time	Freq	Tod(s)	Lat	Long	Hgt	Smaj	Smin	Ang	Gv	Pldval	EtoS1	EtoS2	EtoS3	EtoS4
431	2008/03/06 07:46:00	156.800	27960	3249.489	-11752.573	0	0.189	0.165	0	Y	NYYYYY	61	100	70	53
430	2008/03/06 07:45:58	156.800	27958	3240.773	-11746.236	0	0.244	0.189	0	Y	YYYYYY	49	88	80	67
429	2008/03/06 07:45:57	156.800	27957	3239.637	-11746.850	0	0.720	0.581	0	Y	YYYYYY	50	88	83	66
428	2008/03/06 07:45:52	156.800	27952	3240.499	-11745.955	0	0.418	0.239	0	Y	YYYYYY	49	87	81	67
427	2008/03/06 07:45:51	156.800	27951	3240.495	-11746.330	0	0.327	0.148	0	Y	YYYYYY	49	88	81	67
426	2008/03/06 07:45:37	156.800	27937	3249.617	-11752.503	0	0.389	0.223	0	Y	NYYYYY	61	100	70	53

Sort Scheme: By Index Only, Expand List, Reverse List Order

RF Freq(Mhz) 156.8000, Rx BW (Mhz) .015, Sig BW (khz) 15.0, #Samples/Chan 1024

Locate (Single), Free Run (Continuous), Free-Run Loop Delay(sec) 1

ClearLocData, Average Sel'd Geos, #Geos In DB 3, #Geos in Local DB 432

BaseMap Select, Zoom Map Type, Coastline: LA to, USGS Topo, Map Retrieval Error

Map: Solomans, Westwood, Los Angeles, Corona, Banning, Palm Springs, San Diego, etc.

Status: LA Rect: 3405.900, -11911.500 - 3205.400, -11600.300

Rect(km), Zoom In x2, Zoom Out x2, Meas. Dist., Select Item(s), Zoom on Selection, Restore Default Settings

Map Cntrl, Data Mgmt, Notch Filter OFF/OFF, Cursor 0 88.100 -87.42

Spectral Plot: LOMA2, OTAY2, PEND2, SANC2

Measured Path Length Differences(km): LOMA2-OTAY2, LOMA2-PEND2, LOMA2-SANC2, OTAY2-PEND2, OTAY2-SANC2, PEND2-SANC2

Cursor 0 0.00 0.35 0 #Val PLDs

PLD Valid: PLDs(km) [-1.920, -11.18, 14.464, -19.21, 16.034, -20.358], TDOA(usec) Val. Flags [-6.401, -37.26, 48.213, -64.04, 53.447, -67.86]

One Peak PkCurvOk, PkSrchOk, PLD In Rng, PLD Correlation Data