Intro to Location
Mobile and Ubiquitous Games
ICS 163
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Computing with Location

• Navigation
• Global Location
  • All things GPS
• Model-based localization vs. fingerprinting
  • Localization beyond GPS
• Beyond localization
  • Nomatic*IM context
Intro to Location

- The value of location vs the value of the killer app
Intro to Location

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Tools for Navigation

• Navigation Tools
  • Clocks
  • Odometer
• Electronic Aids
  • Radar
• Radio navigation aids
  • ground-based
  • space-based
Intro to Location

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Intro to Location

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Thinking about Navigation
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• Who calculates position?
  • User
  • 3rd party
Thinking about Navigation

- Who calculates position?
  - User
  - 3rd party
- What’s the impact?
All about GPS
Intro to Location

Global Location GPS
Intro to Location

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Intro to Location

Global Location GPS

• Latitude and Longitude
  • What are they?
  • Datum
Intro to Location

• Describe Lat, Long
  • (x, y)
• Datum
  • mean
  • earth models
Intro to Location

Global Location GPS

LATITUDE
N° 90°

N/S
89° 1.34'
90° 0' 0"

LONGITUDE
0° - PRIME MERIDIAN

INTERNATIONAL DATE LINE
S

WATER
N

O

GREENWICH
-180
180W

+180
Global Location GPS
Intro to Location

Global Location GPS

- Mean Surface
- Datum
- WGS-84
- World Geodetic System 1984
- (0,0)
Global Location GPS
Global Location GPS

(33.6, -117)

(x, y)
Global Location GPS
Global Location GPS

- Current GPS
  - Fully operational
  - accurate, continuous, global 3-D position and velocity
  - also distributes universal coordinated time
  - 24 original satellites (32 now)
  - 6 orbital places
  - 4 satellites per plane
  - not geosynchronous
  - world-wide monitoring stations

Global Location GPS

• Current GPS
  • Based on
    • Time Of Arrival (TOA) of radio signal
    • knowledge of satellite orbits
  • Satellites have atomic clocks on board
  • 2 frequencies
    • L1 1575.42 MHz
    • L2 1227.6 MHz
Global Location GPS

- Current GPS
- Broadcasts
  - Time of transmission
  - Ephemeris: Precise satellite orbital info
  - Almanac: System health info, rough orbital info for all satellites
Intro to Location

Global Location GPS
Global Location GPS

- Current GPS

- Receiver requirements
  - Must have local clock
  - 3-D position requires four satellites (assumptions matter)
    - four unknowns (what are they?)
    - time or height reduces this
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