# The deployment and the initial result of the Internet-Based Augmentation System for Global Navigation Satellite Systems

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## Background

- The importance of discovering geographical location information of a node increases.
  - In mobile and ubiquitous computing, the position of a node is not necessarily fixed.
- Global Navigation Satellite Systems (GNSS) is a very effective device.
  - GNSS can be used in the outdoors of the Earth.
- However, GNSS has limits on accuracy.
  - To enhance the accuracy, it is necessary for a node to receive the error correction data.



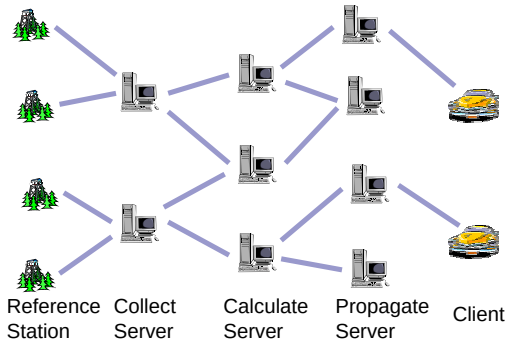
## Problems in the existing GNSS correction systems

- Service Area
  - It can only cover a limited area with medium wave beacon or FM radio wave.
- Interactivity
  - It is difficult to send dedicated correction data to each user.
- Device dependency
  - Users have to use a different device for every system.

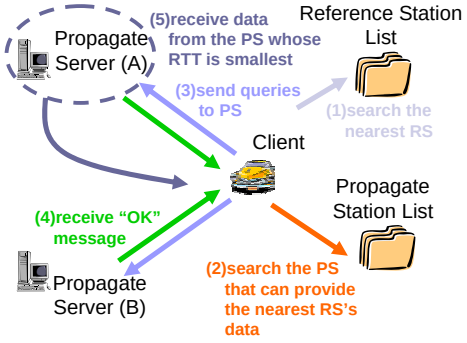
I have proposed the Internet-Based Augmentation System for GNSS (IBAS)



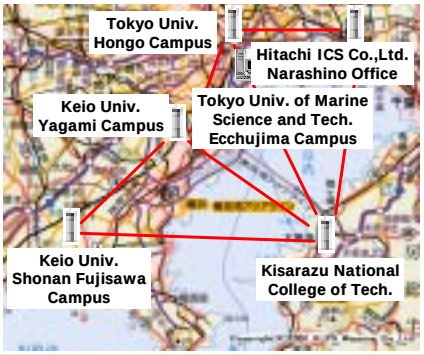
## System architecture of IBAS




## Flow of Server Select Mechanism




## Deployments of RSs in Tokyo



# Deployments of RSs in Kansai


# Configuration diagram of RS

Antenna

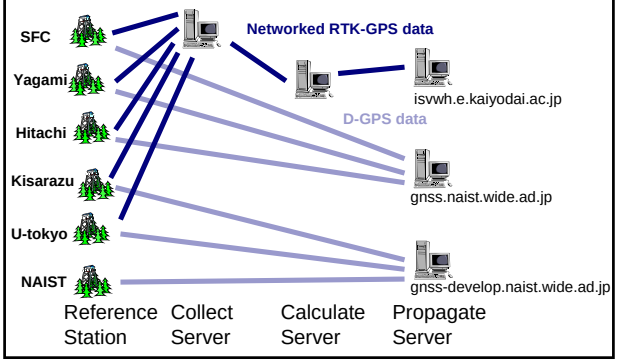
Observe Server

Campus LAN

Internet

GPS / GLONASS Receiver

# Testbed architecture

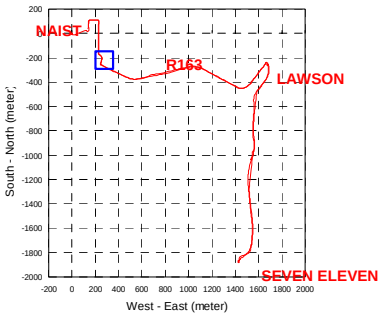



# Positioning Experiment

- I observed D-GPS positioning results with IBAS during moving around NAIST by car.
  - A Client is connected with AirH" 32k.
  - RS and PS at NAIST are selected automatically by the above-mentioned mechanism.

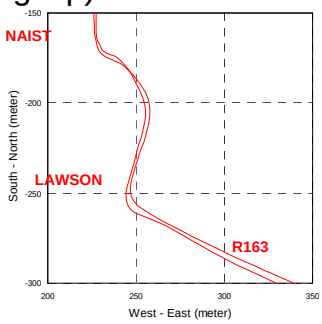


# Positioning with D-GPS

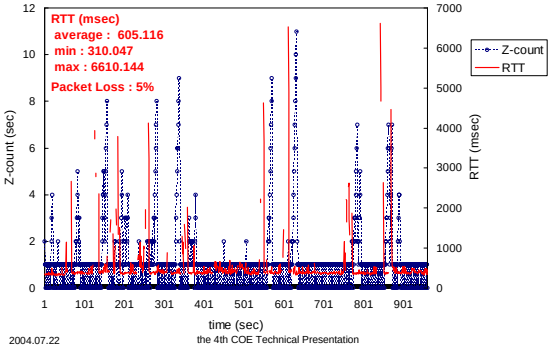





# Positioning with D-GPS (Scaling Up)



## Transition of RTT and data delay






## The enhancement of IBAS

- To realize higher reliability and accuracy…
  - Removal of the error ingredients from observation data
    - Various error elements are contained in observation data.
  - Networked D-GPS
    - Enabling mobile nodes to position in high accuracy even if they are moving in high speed.



## Summary

- To enable mobile nodes to locate their position in high accuracy, I proposed the Internet-Based Augmentation System for GNSS (IBAS).
- IBAS can provide dedicated GNSS error correction data with each node.
  - A user finds out the nearest RS and PS that can provide the data calculated at that RS automatically.
- I have established the testbed of IBAS.
  - A client could obtain high accuracy location information, enough to decide the lane he ran on.