

A Location System based on Sensor Fusion: Research Areas and Software Architecture

2. *GI/ITG KuVS Fachgespräch “Ortsbezogene Anwendungen und Dienste”*

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- various applications require location information
 - ◆ mobile ad-hoc routing: position based routing
 - ◆ mobile business: context-aware applications
- various location systems are around
- no highly accurate, easy-to-use indoor location systems is available

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- various applications require location information
 - ◆ mobile ad-hoc routing: position based routing
 - ◆ mobile business: context-aware applications
 - various location systems are around
 - no highly accurate, easy-to-use indoor location systems is available
- ⇒ we investigate sensor fusion based location systems

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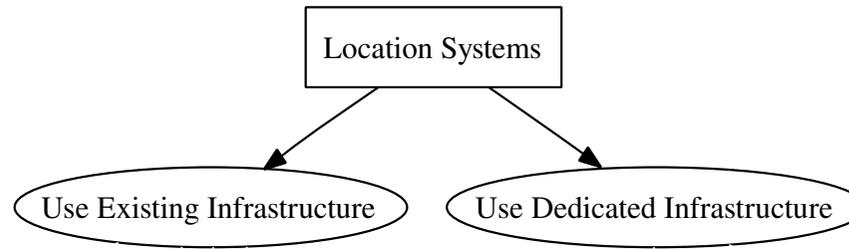
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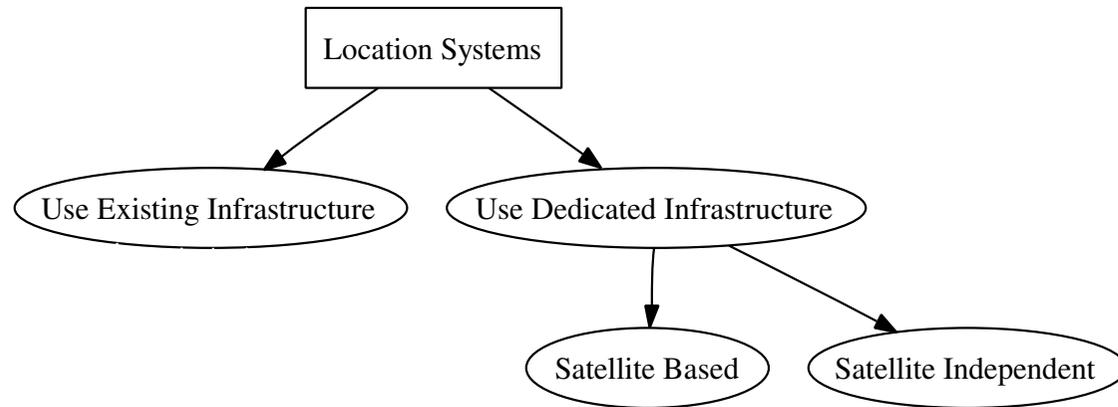
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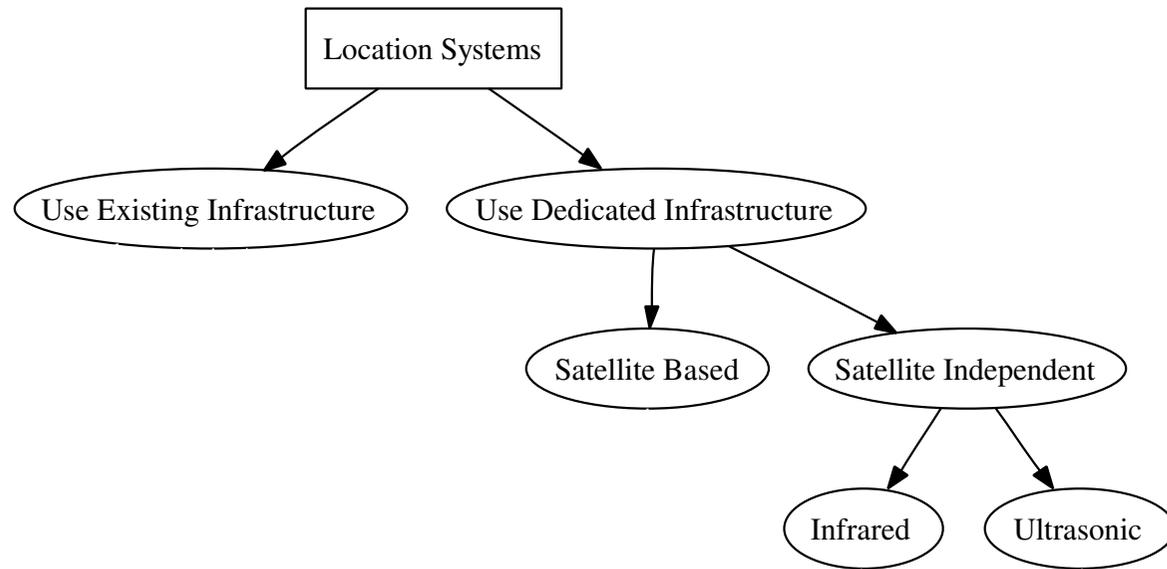
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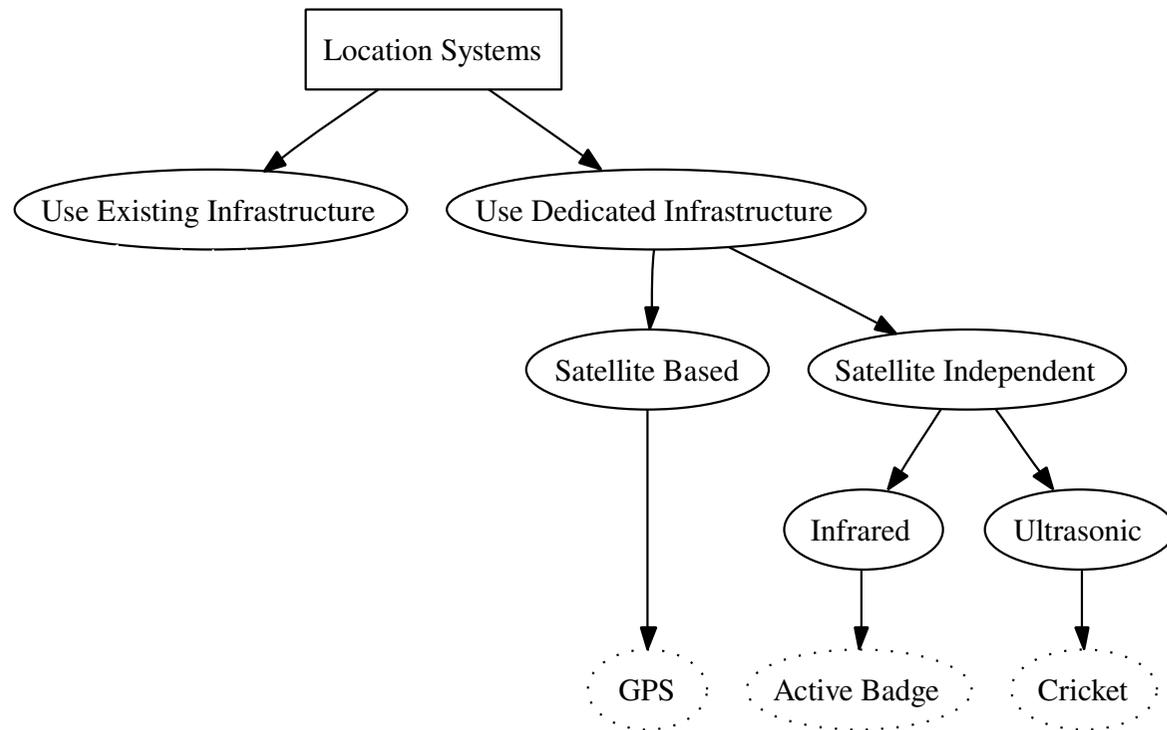
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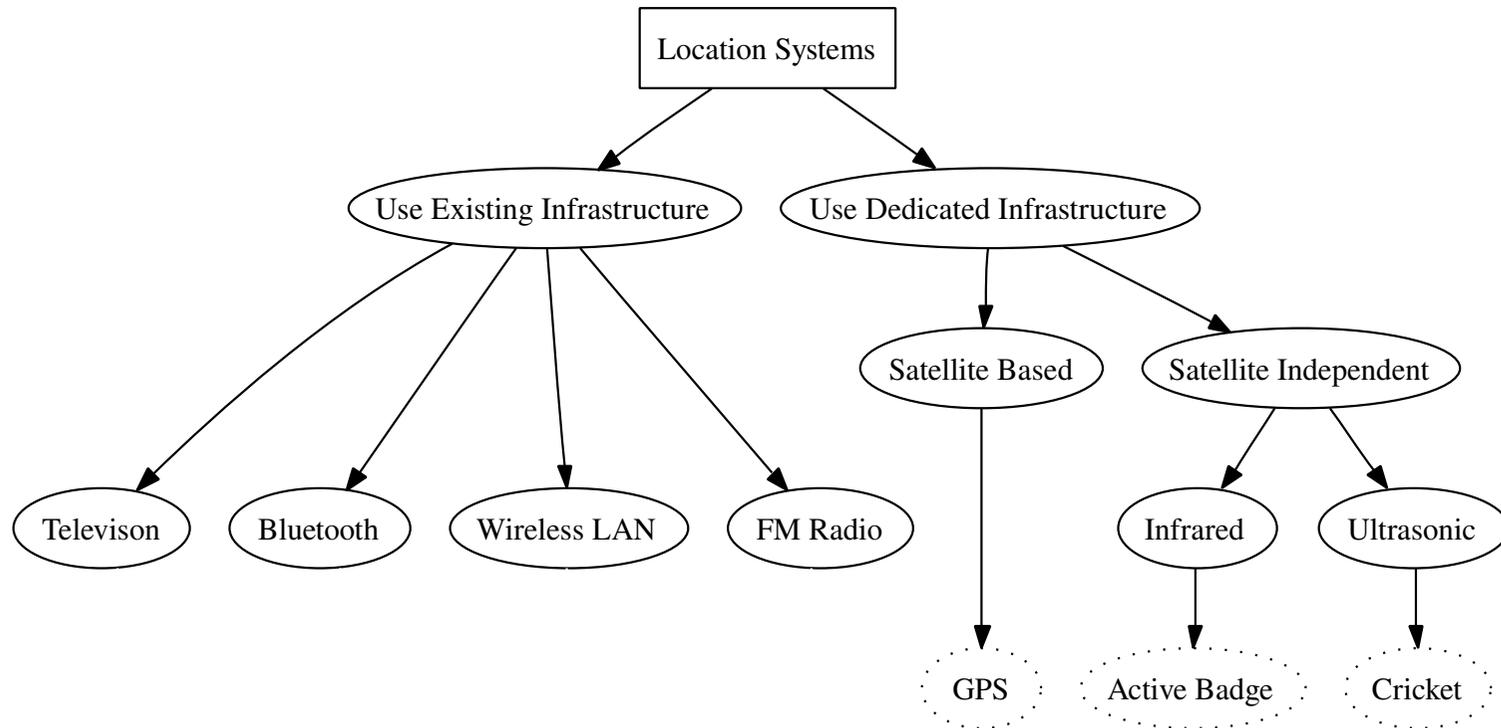
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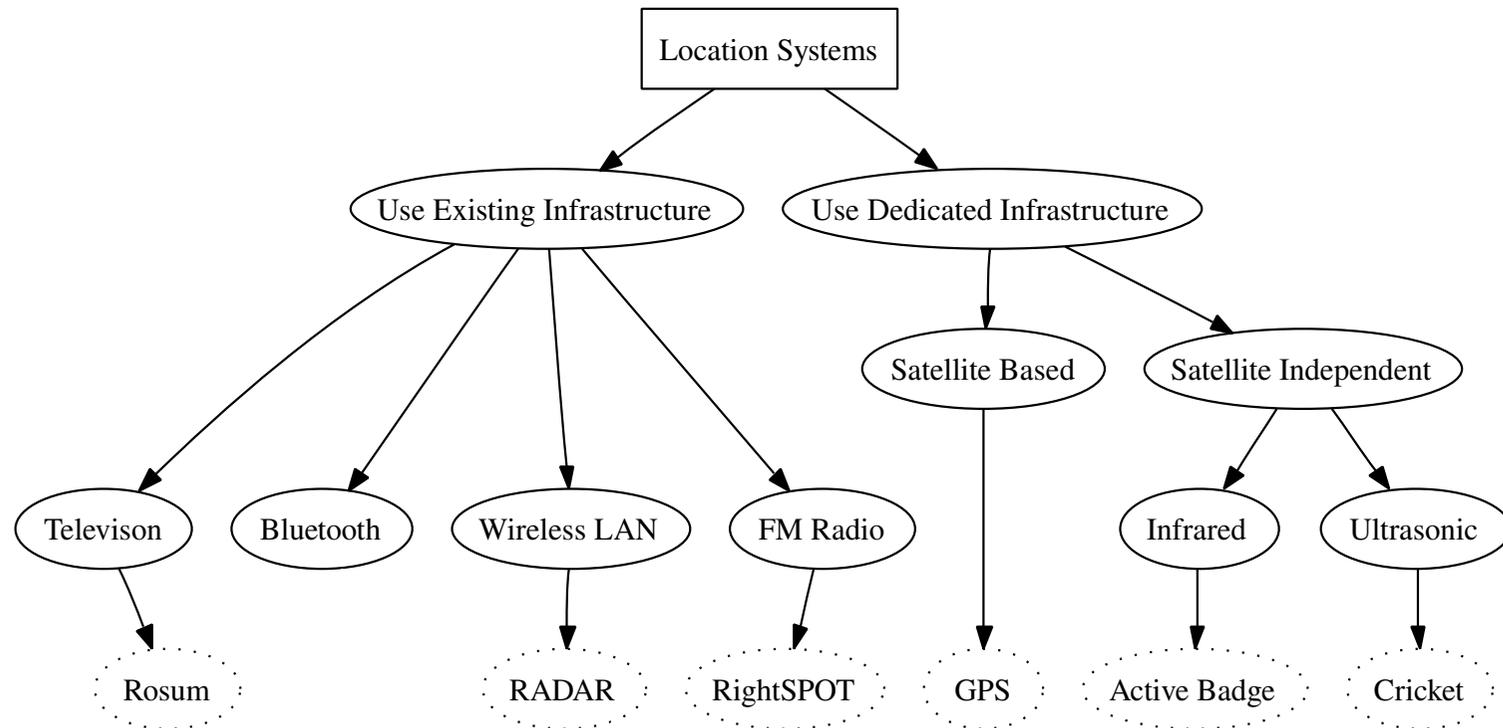
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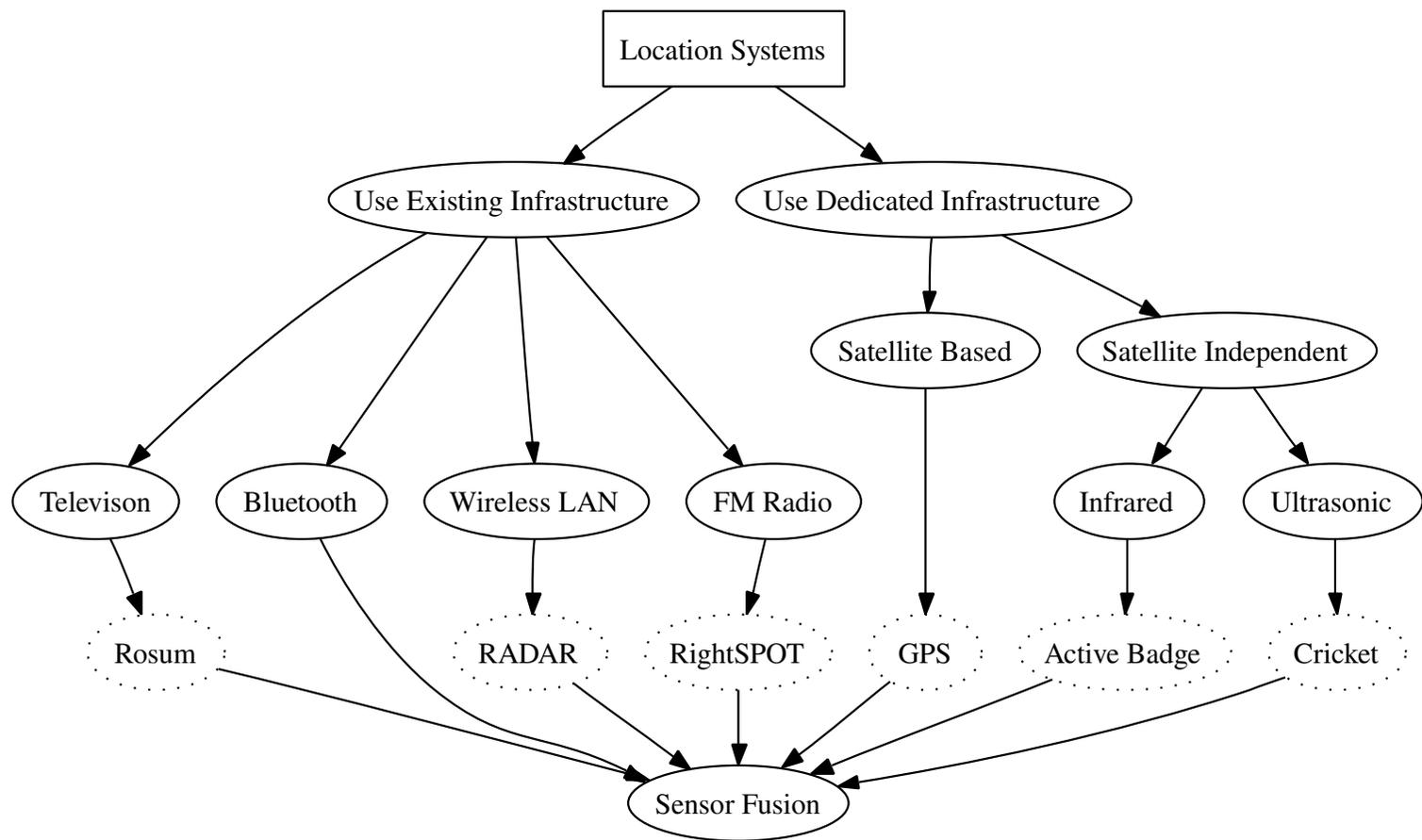
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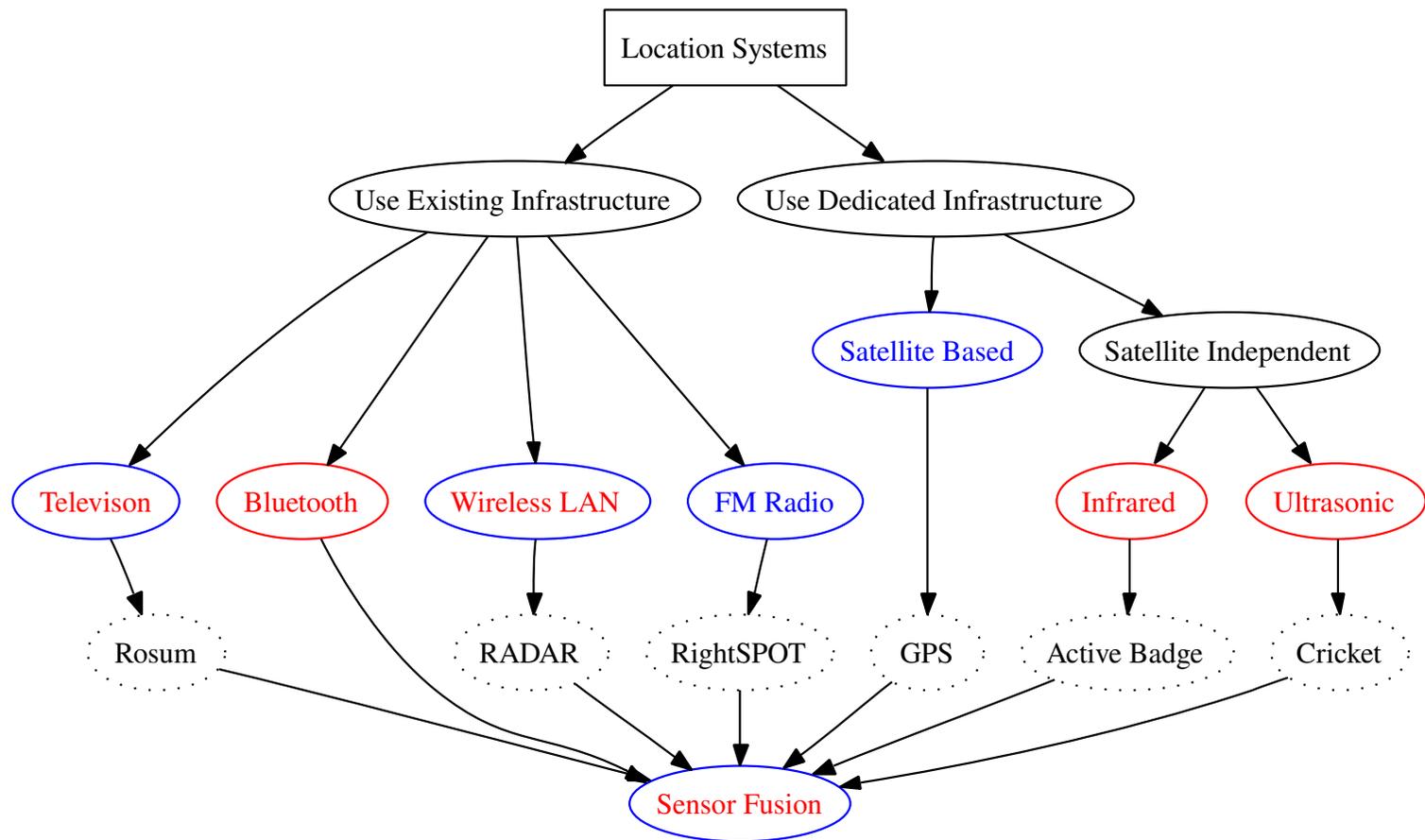
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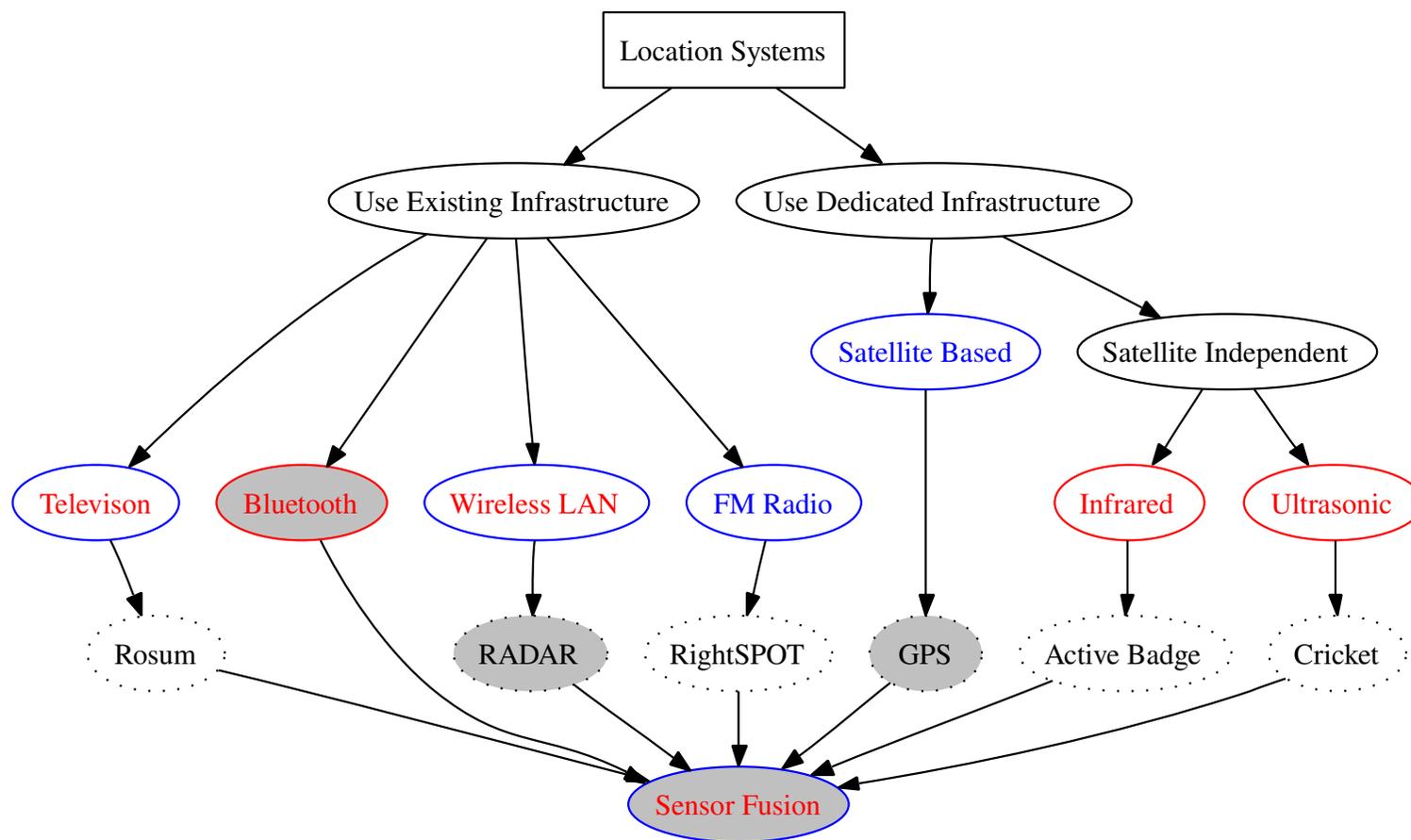
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RADAR - Overview

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● RADAR - Database

● RADAR - Positioning

● Bluetooth - Overview

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- Microsoft Research, 2000
- wireless LAN access points are used to determine the position of mobile devices
- two step approach:
 - ◆ training phase: a database with signal strength values of the operation area have to be created
 - ◆ location phase: uses this database
- median distance error 2.5 meters

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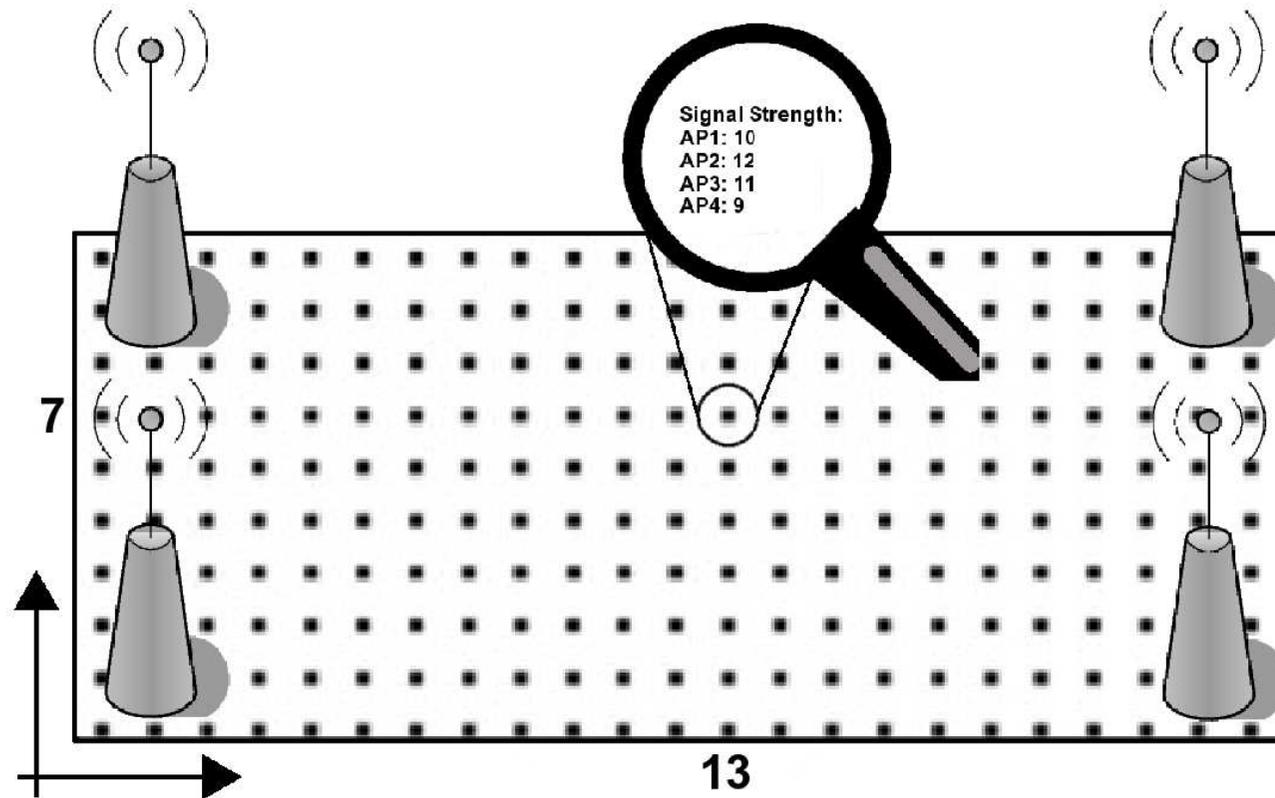
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- a dense grid of measurement points is required



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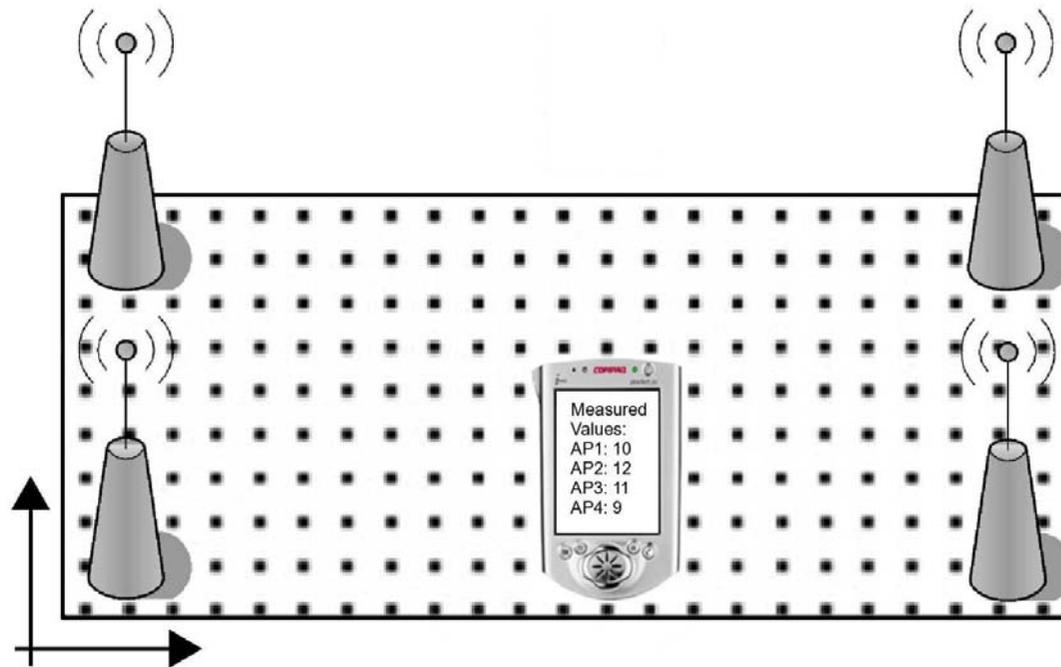
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- the mobile device measures the signal strength of the access points in communication range
- the mobile device compares this sample with the values stored in the database



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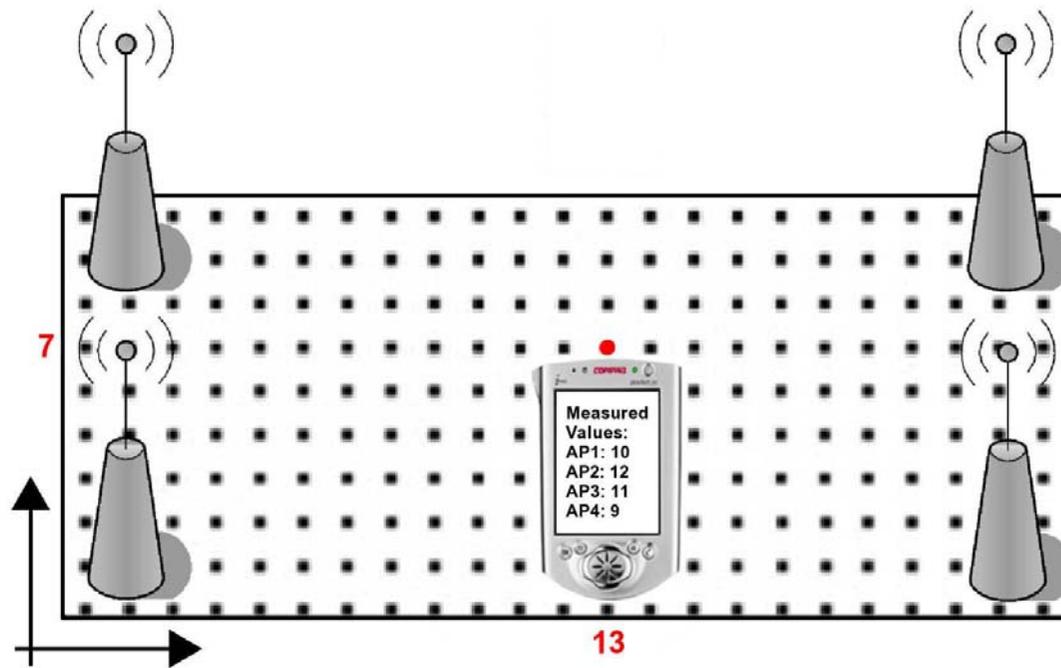
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- invented to replace low-bandwidth cabling e.g. computer peripherals
- communication range up to 10 meters
- proximity approach proposed by
 - ◆ a research group at the Lulea University, Schweden
 - ◆ a research group at the Chuo University, Japan

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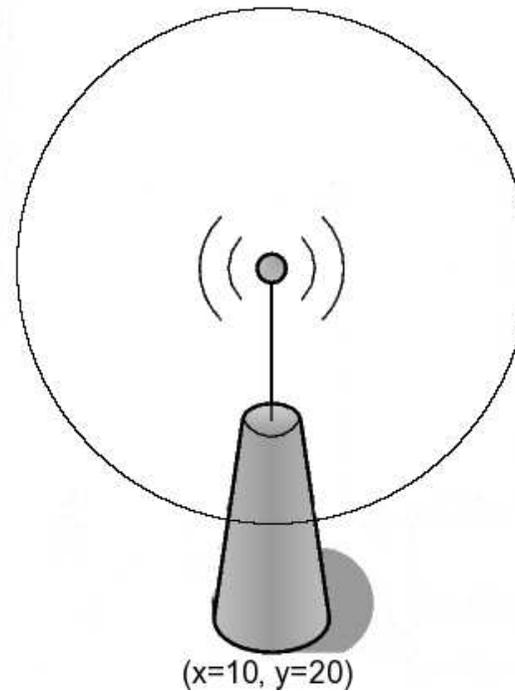
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■ proximity based location determination



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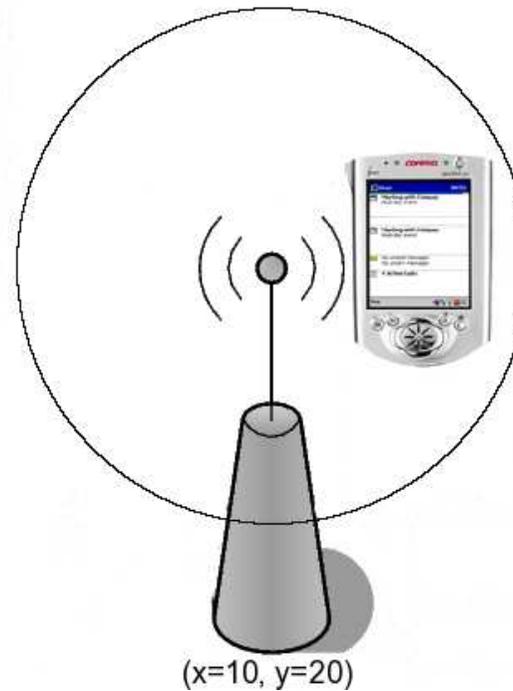
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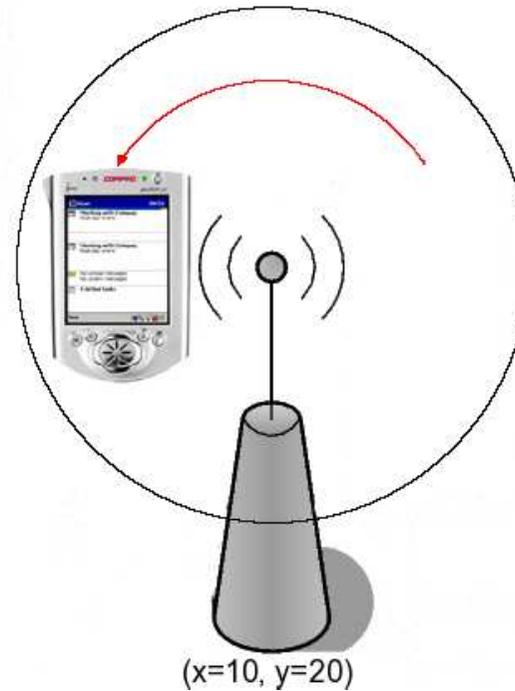
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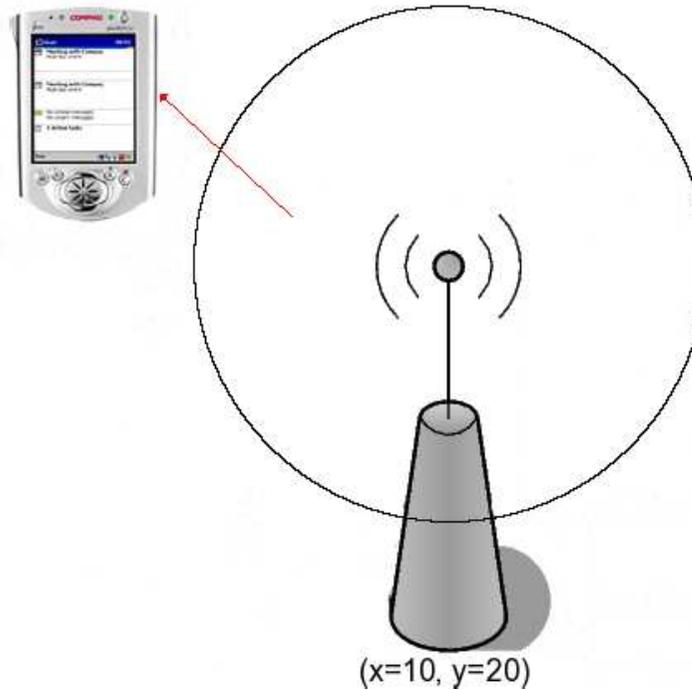
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● Sensor Fusion - Principle of Function

● Sensor Fusion - Challenges

● Generic Location System Architecture

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- proposed by PlaceLab and a research group of the University of California, USA
- modern mobile devices contain a multiple of communication and sensor interfaces (e.g. Wireless LAN, Bluetooth, GSM, ...)

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- modern mobile devices contain a multiple of communication and sensor interfaces (e.g. Wireless LAN, Bluetooth, GSM, ...)

⇒ exploit the correlation between sensed parameters to increase the positioning accuracy and availability

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Sensor Data:

Wireless LAN

Bluetooth

GSM

...

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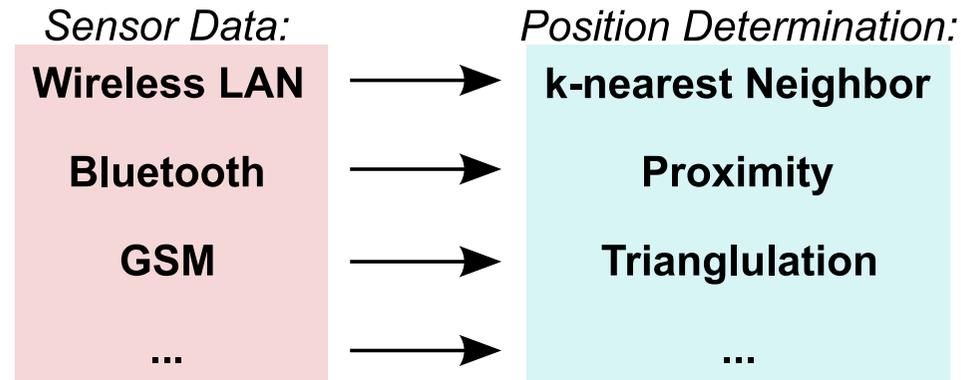
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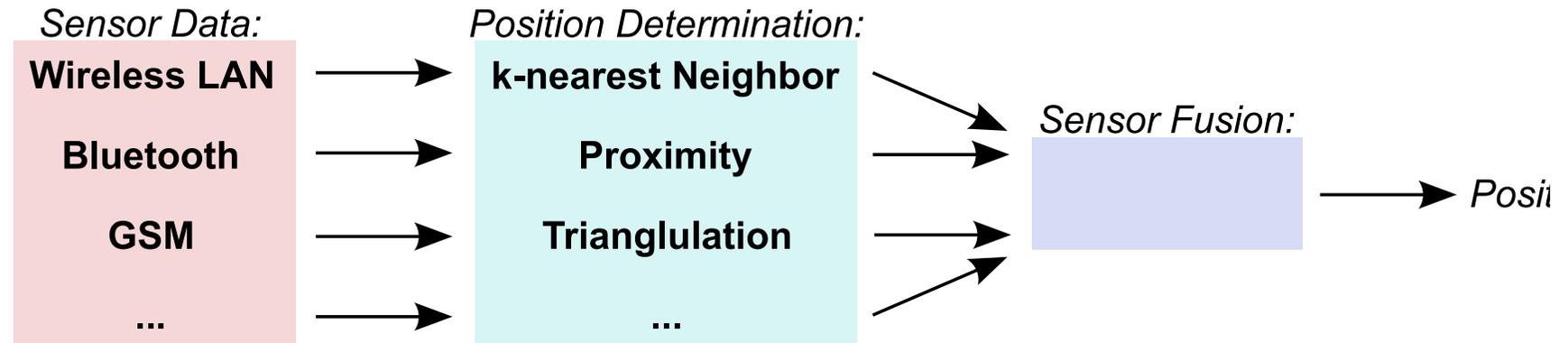
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- challenges:
 - ◆ different sensor types provide different accuracy and precision
 - ◆ sensor data is often noisy
 - ◆ position estimates from different sensors may conflict with each other

Generic Location System Architecture

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<<Interface>>
SensorFusionAlgorithm

<<Interface>>
PositionDeterminationAlgorithm

<<Interface>>
Sensor

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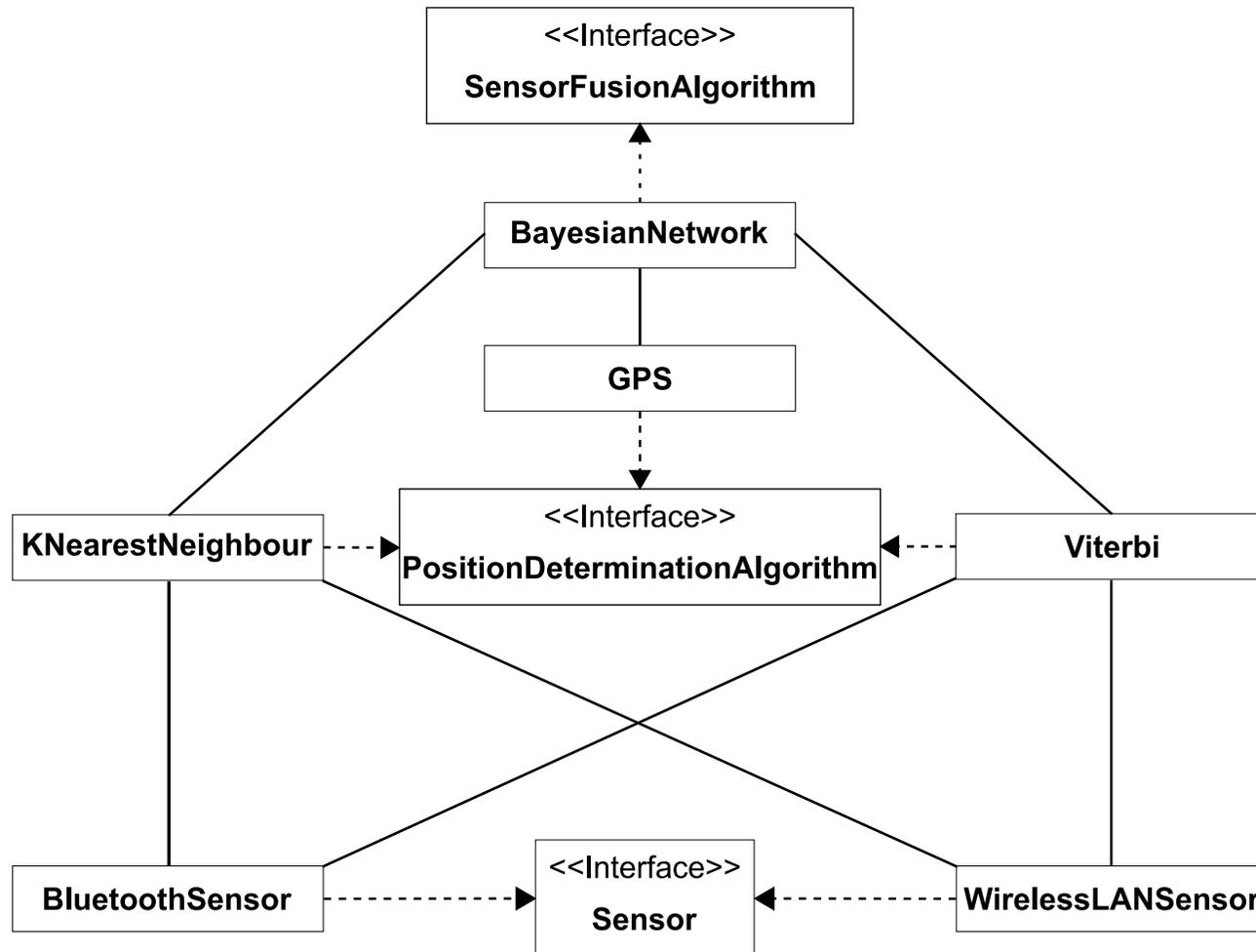
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