

Application of GIS and GPS to Railway Operations – *Case in Japan and Further Possibilities* –

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Outline of the Presentation

- 1) Development of the Digitised Railway Facility Management System
- 2) Application of the GPS to Railways
- 3) Utilization for Railways with Vertical Separation



1) Development of the Digitised Railway Facility Management System

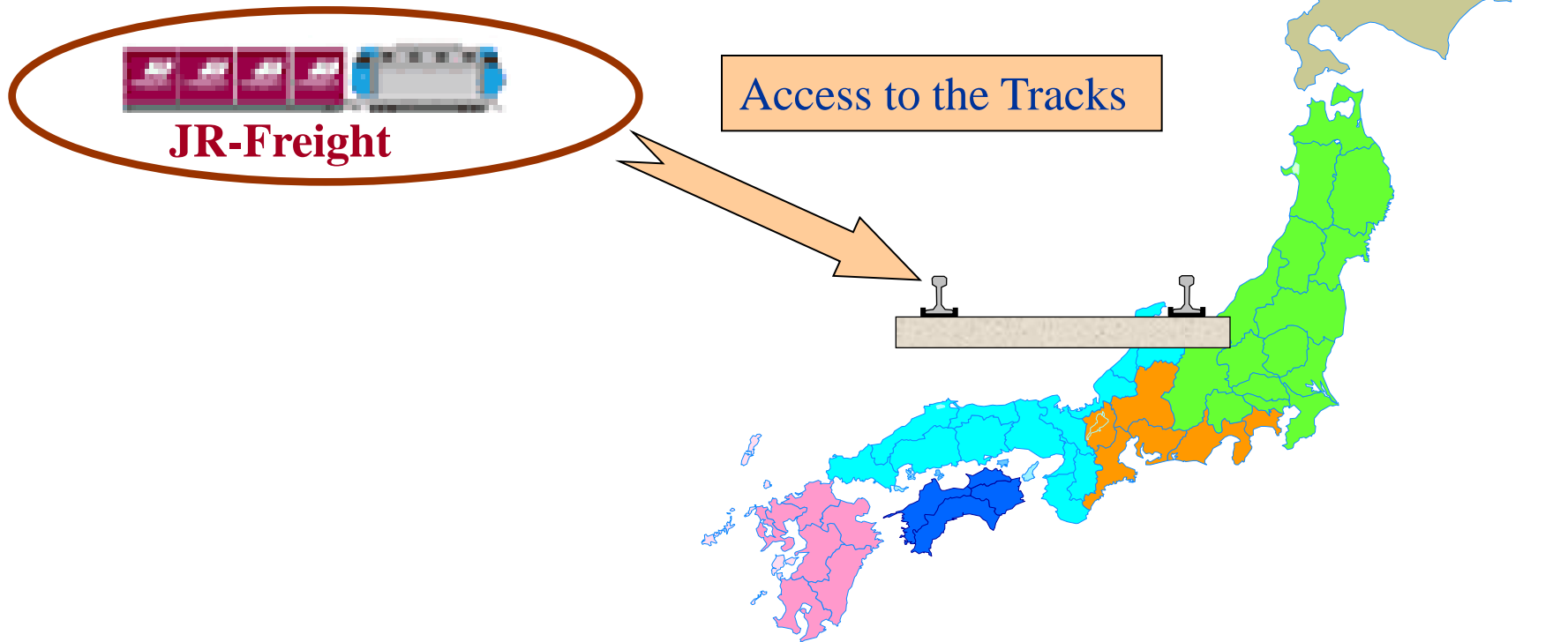
2) Application of the GPS to Railways

3) Utilization for Railways with Vertical Separation

Outline of the JNR Restructuring

JR-Freight and 6 Passenger JR Companies

JR-Freight does not own its infrastructure and accesses to the 6 passenger railways' tracks.



Problems in Traditional Facility Management

Difficulties in:

- 1) identifying and obtaining the latest information;
- 2) sharing information among different sections;
- 3) managing the maintenance and upgrading of data;
- 4) developing coordination with train operations.



Characteristics of the System

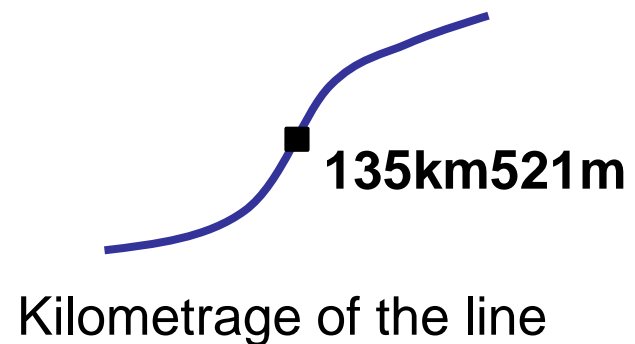
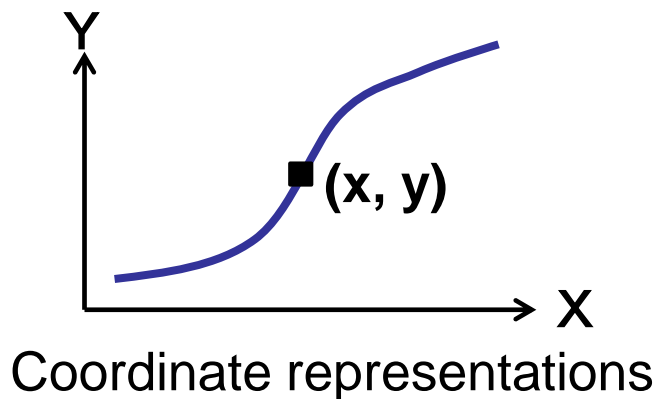
Problem

Difficulties to allocate the coordinate representations to the alignment and the various assets.

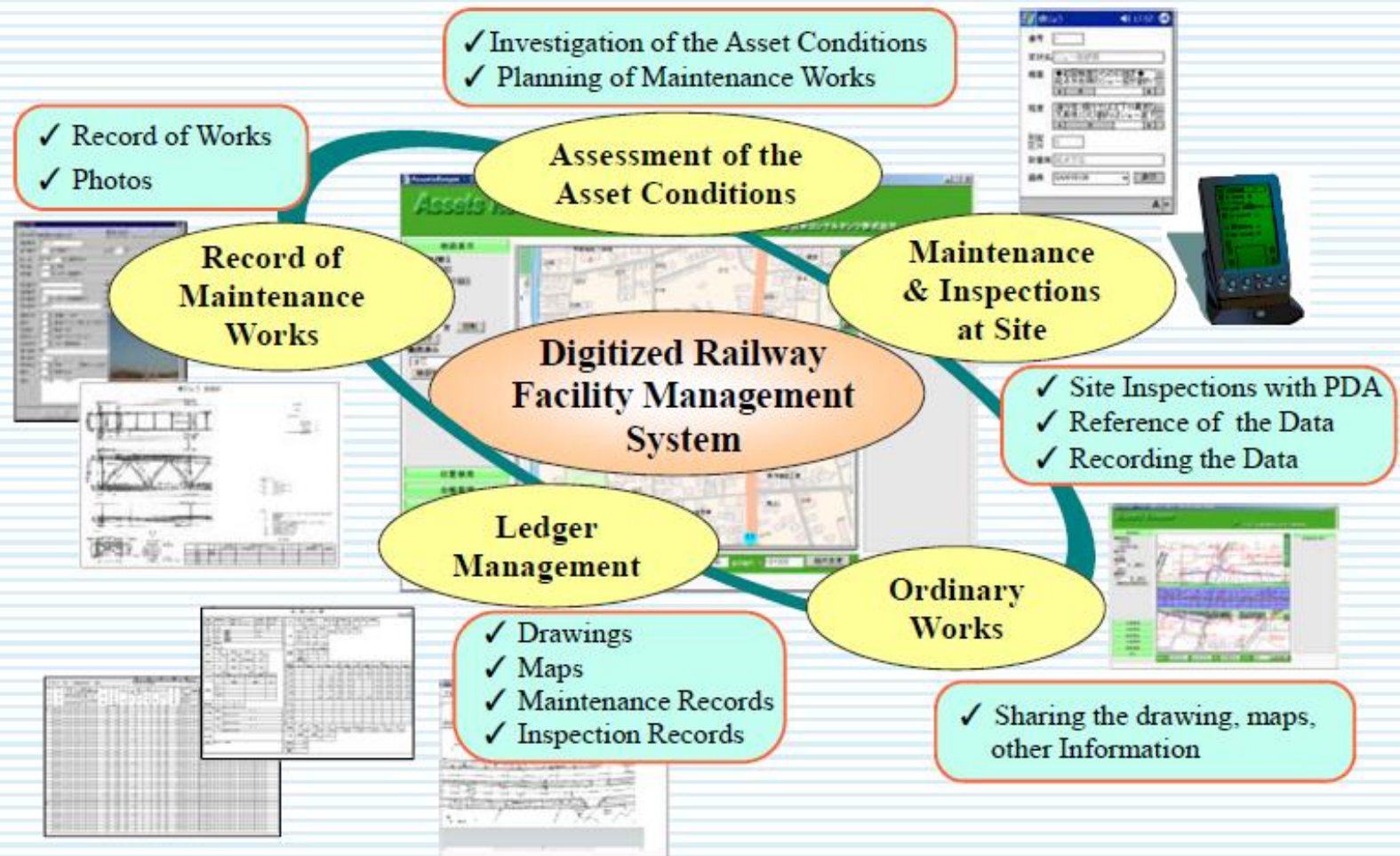


The New Asset Management System

All facilities are linked to the kilometrage of the rail lines.



Function of the System





Effects and Utilization of the System

- 1) As the updated data are recorded to the database, **the latest information can be easily identified.**
- 2) As the data are electronically recorded to the database, **it can be retrieved in a timely manner.**
- 3) **The digitised asset information provided a smooth and seamless data flow for construction and maintenance works.**
- 4) It has become much **easier to share updated information among different departments.**

Further Development of the System

Usage of the system has been developed in various ways.



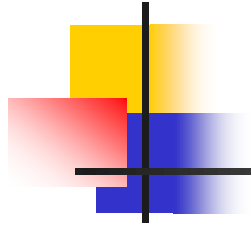
The system can be combined with other related data.



Utilization for Disaster Prevention.
(Integration with topography images)



Utilization for Urban Planning
(Integration with 3-D images)



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“PRANETS” introduced by JR Freight in 2008

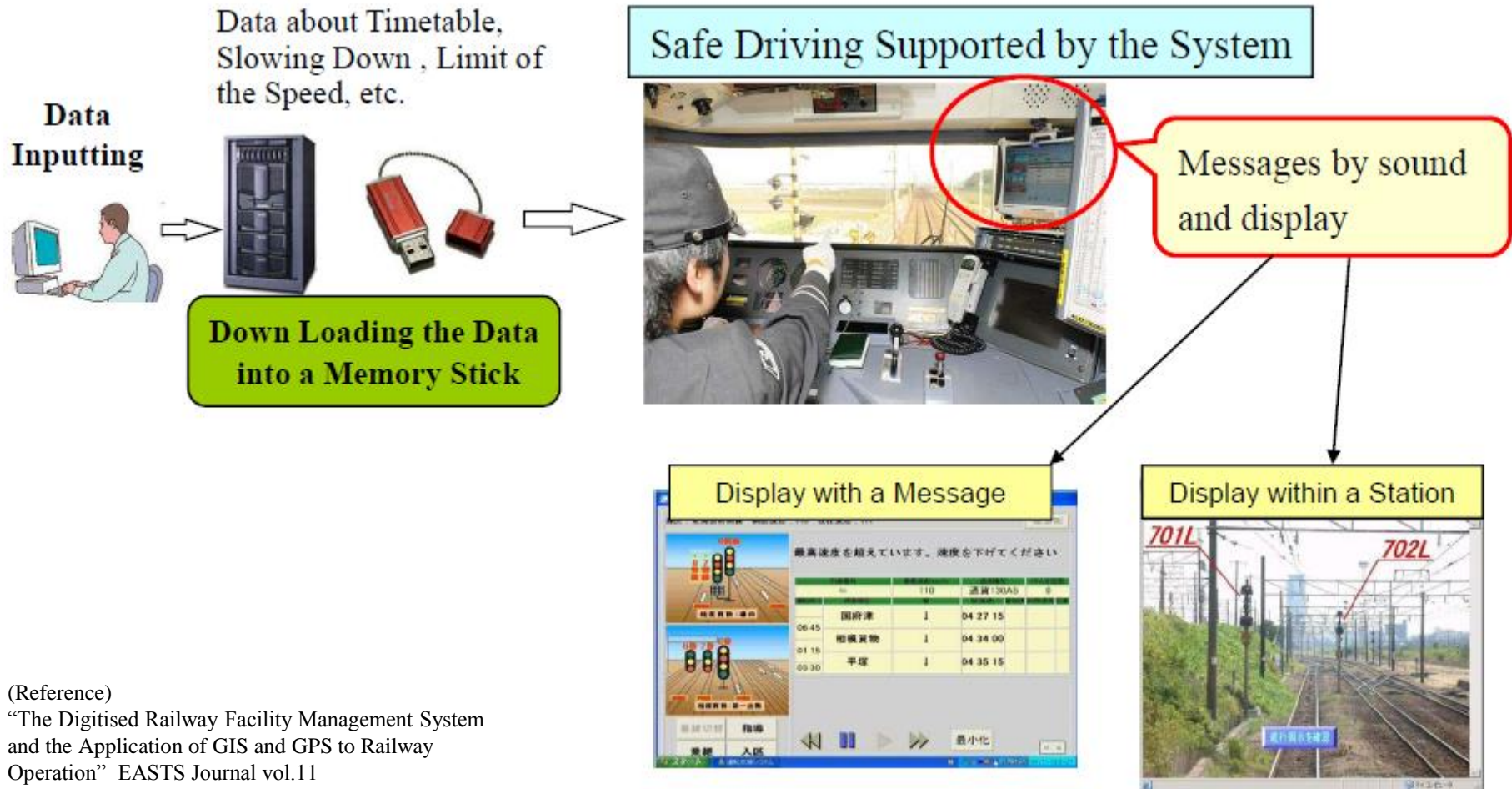
PRANETS : Positioning system for RAil NETwork
and Safety operating.



Two Functions

- 1) A train driving support system
- 2) A container information system

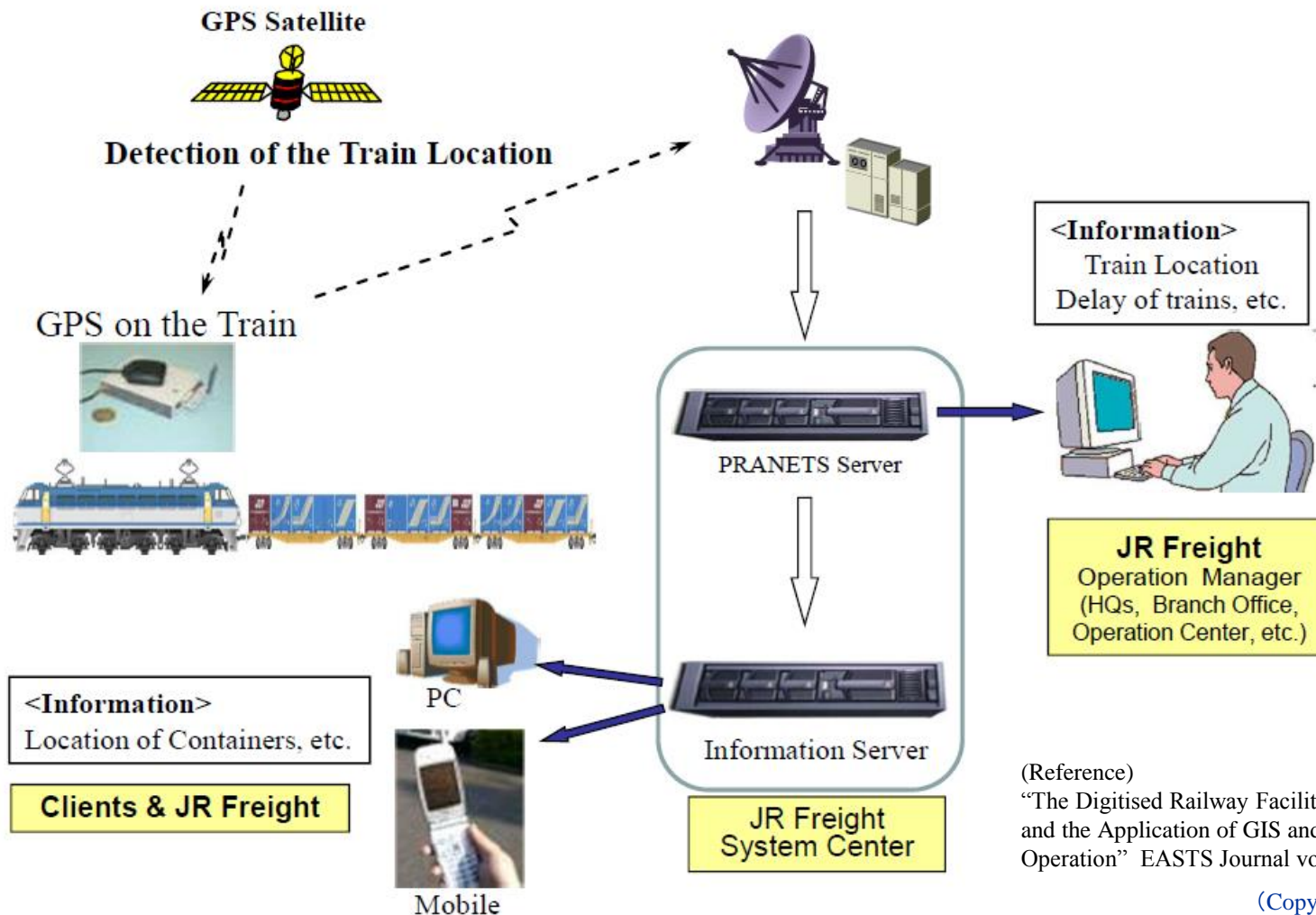
PRANETS: A Train Driving Support System



(Reference)

“The Digitised Railway Facility Management System and the Application of GIS and GPS to Railway Operation” EASTS Journal vol.11

PRANETS: A Container Information System



(Reference)
“The Digitised Railway Facility Management System and the Application of GIS and GPS to Railway Operation” EASTS Journal vol.11

“Portable Tablets” utilized by JR East (1)

JR East introduced “Portable Tablet System” in 2013.

At present, all drivers and conductors take a portable tablet with them.



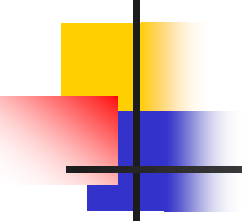
The necessary information can be transferred to the tablets particularly in unusual operational conditions.

They do not need to carry bulky manuals as the tablet also includes the data of the related manuals.

“Portable Tablets” utilized by JR East (2)

Conductors and station staff can provide appropriate information to the passengers.



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Vertical Separation of Railways

Vertical Integration

**Railway
Operation**

Infrastructure

Vertical Separation

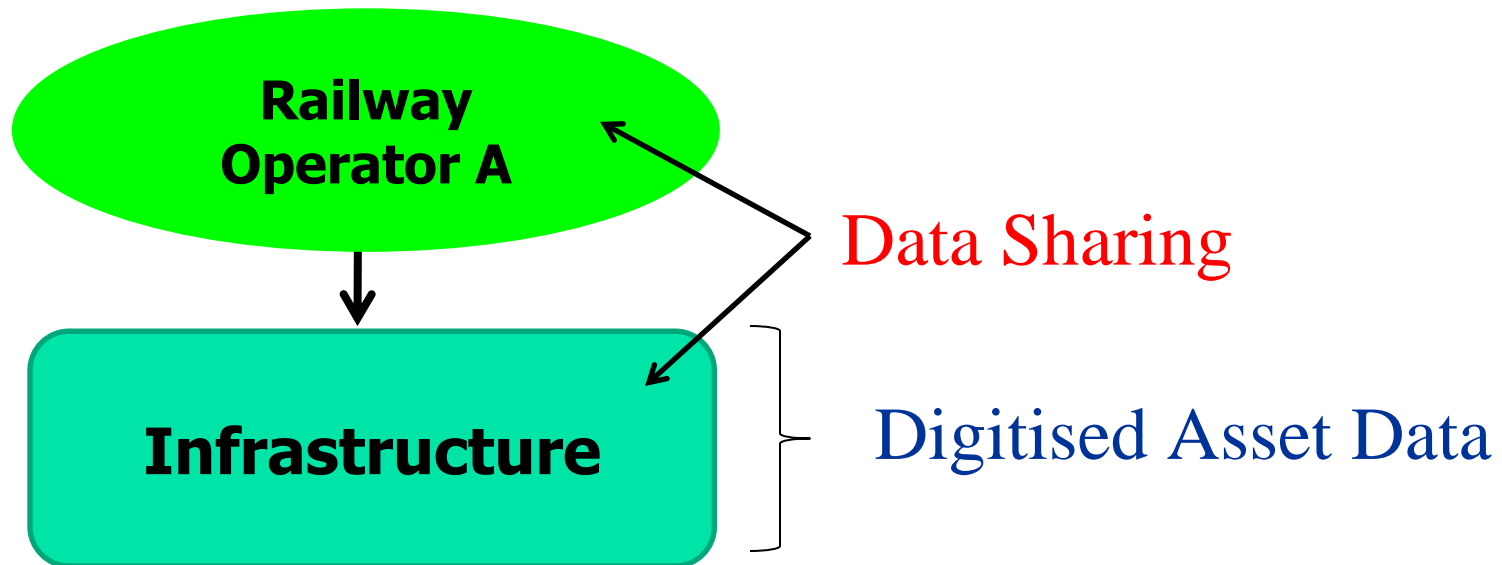
**Railway
Operator A**

Access

Infrastructure

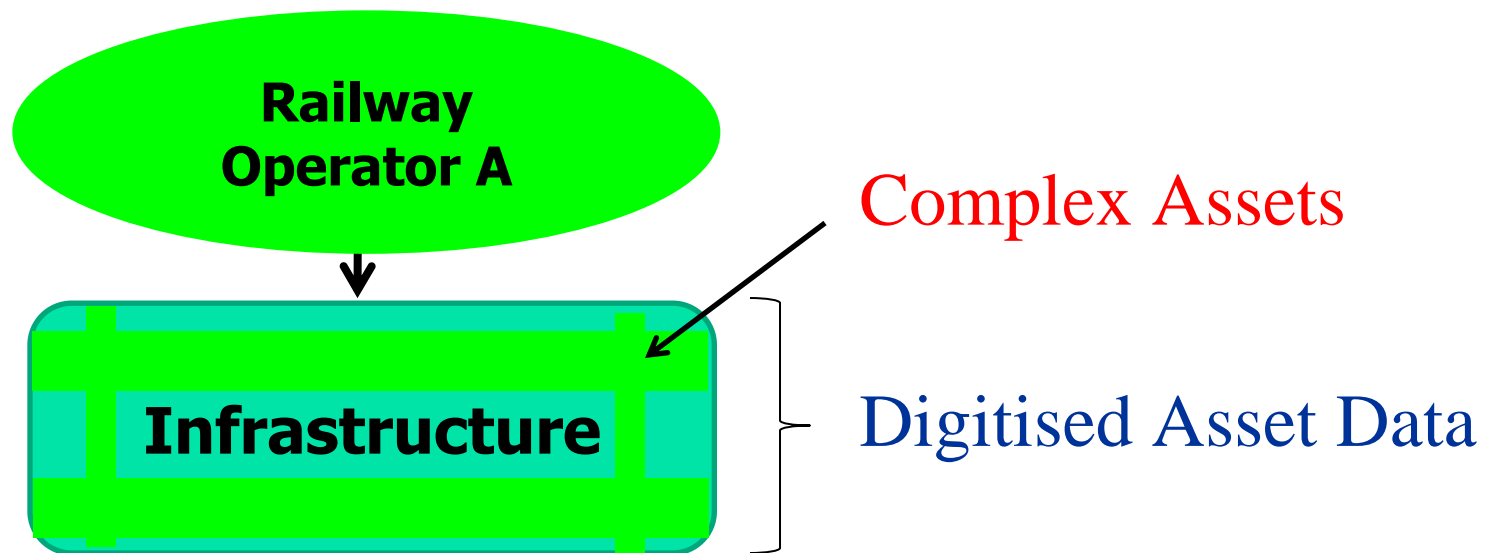
Merit of Utilization of GIS (1)

Sharing the data among different entities.



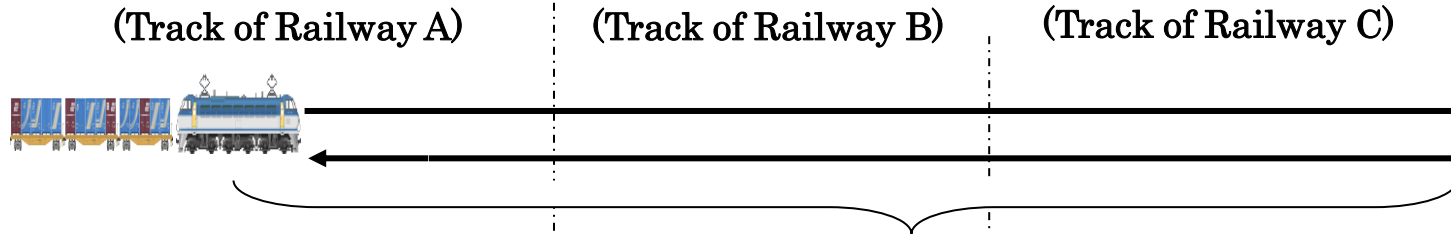
Merit of Utilization of GIS (2)

Management of Complex Infrastructure Assets.



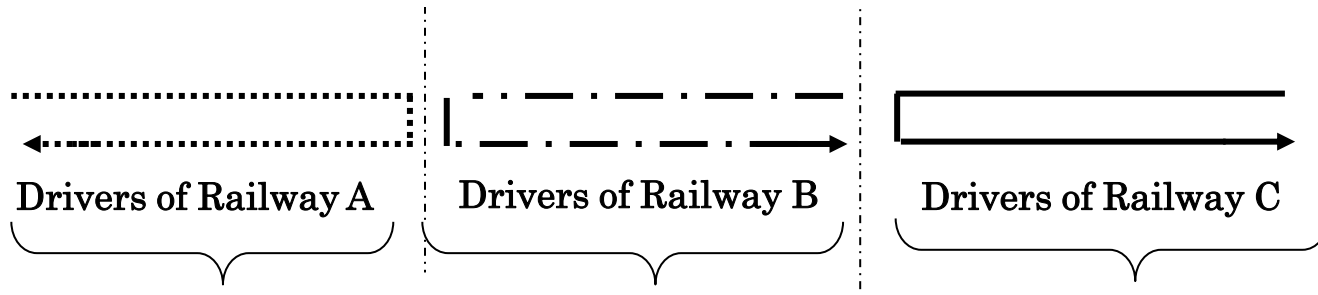
Train Driving by Vertical Separation/Integration

1) Operation of vertically separated railways (Ex. JR Freight)



Drivers travel a long distance on other entities' track

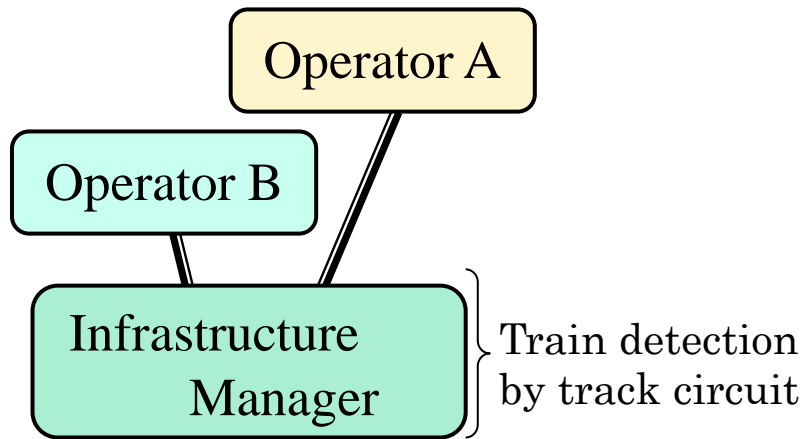
2) Operation of vertically integrated railways



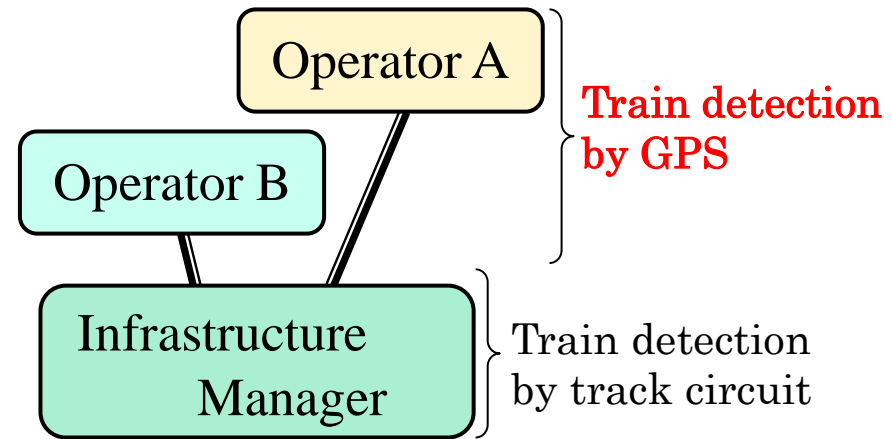
Drivers travel on its track only and they are familiar with the track.

Merit of Utilization of GPS

Reliable Train Operation with GPS Application.



Train Detection without GPS



Train Detection with GPS



Summary

- 1) Digitising the railway asset information has various advantages.

- 2) GPS can be applied to railway operation effectively.
 - > Application of GIS and GPS is especially effective for vertically separated railways.



Thank you for your attention.

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