Presented at the FIG Regional Conference 2024,
14-16 November 2024 in Kathmandu, Nepal

Trimble Advanced Positioning
28 October 2024

Resilient CORS Infrastructure for Efficient Land Management and Disaster Mitigation

Subhash Kumar
Regional Sales Manager
TRIMBLE South Asia

© 2021 Trimble, Inc - All Rights Reserved - Confidential and Proprietary Information

Trimble

Trimble is a global technology company that takes on the **world's biggest challenges** so customers can unlock **a better, faster, safer and greener future**.

WHERE
WE CAME FROM

A history of **outstanding innovations** and many **“firsts”**

1984
First commercial GPS positioning product

1992
First handheld marine GPS

1994
First commercial RTK receiver with on-the-fly (OTF) capabilities

1999
First GPS grade control system for construction

2016
First total station with 3D scanning, imaging and optical measurements

THE INDUSTRIES
WE SERVE

Innovation
across industries

We exist to **empower** our customers so they can **improve how we live, eat and move** for a better quality of life and a better future.

Construction

Building tomorrow's infrastructure

Transportation

Delivering the goods of commerce

Geospatial

Building a digital model of the earth

Agriculture

Enabling a safe and reliable food supply

GNSS CORS Infrastructure

- Backbone of Precise Positioning
- Maintains Common Reference Frame
- Ensure consistency and accuracy
- Supports broad range of Positioning, Navigation and Timing Applications

Resilient GNSS

Use of technologies to protect Global Navigation Satellite Systems (GNSS) from interference and jamming

PNT

- **Positioning**

The ability to accurately and precisely determine one's location and orientation referenced to a standard geodetic Reference Frame

- **Navigation**

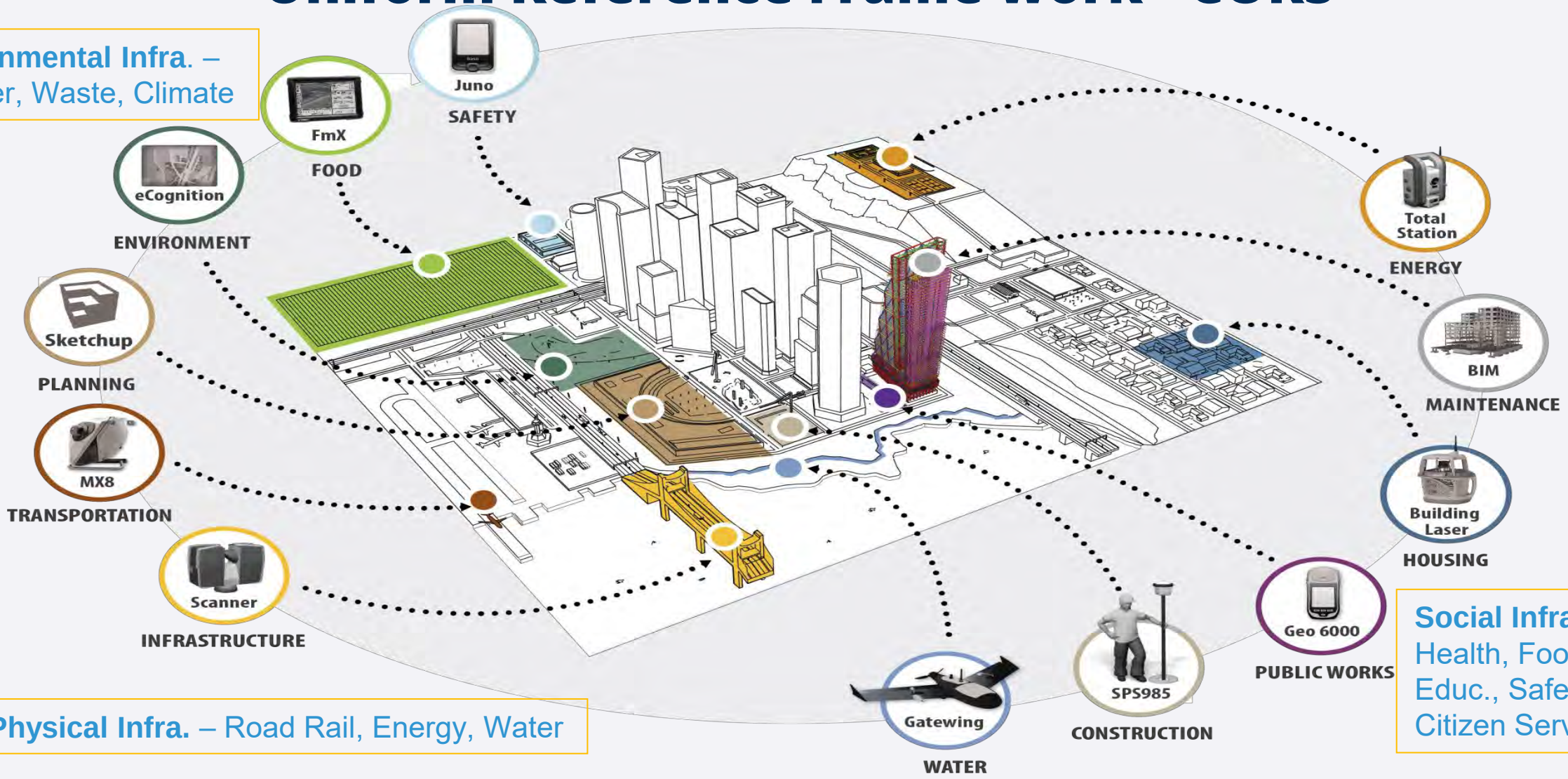
The ability to determine current and desired position (relative or absolute) and apply corrections

Timing

The ability to acquire and maintain accurate and precise time from a standard anywhere in the world within user-defined timeliness parameters & time transfer.

World Class Infrastructure using State of the Art Tech. & Uniform Reference Frame work - CORS

Environmental Infra. – Disaster, Waste, Climate



Physical Infra. – Road Rail, Energy, Water

Social Infra. – Health, Food, Educ., Safety, Citizen Services

CORS will lead to evolution and rapid adoption of GNSS & newer technologies for faster creation of Infrastructure

Advantage of CORS Infrastructure

- No local Reference Station required
- Seamless and accurate positioning
- Consistent coordinate frame
- Higher Productivity, Reliability and Accuracy
- Quick and accurate.
- Economical.
- Makes Surveying simple and uniform.
- Use established mobile wireless infrastructure
- Supports multiple Communication Protocol

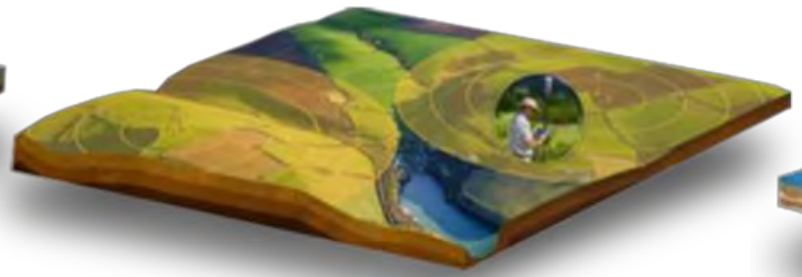
Applications areas

- Surveying
- Survey / Resurvey of Land Parcel
- Accurate asset inventory of land
- Urban planning
- Timely, accurate and equitable processing of property transactions and registrations
- Property tax assessment and collection
- Urban and rural construction
- Infrastructure management (roads, utilities, etc.)
- Disaster planning and recovery (natural disasters, terrorism, etc.)
- Environmental monitoring
- Disaster prevention and relief
- Utility Mapping

Types of GNSS Corrections

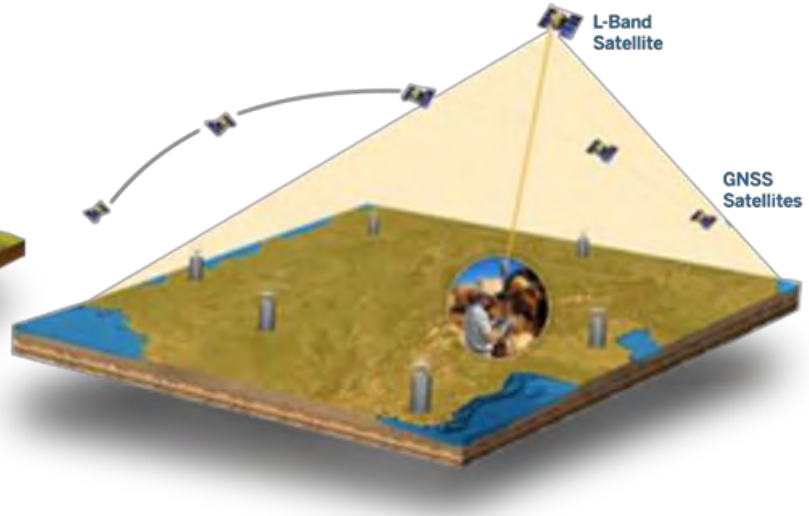
Trimble VRS

RTK-level accuracy without the need to set up your own base station.



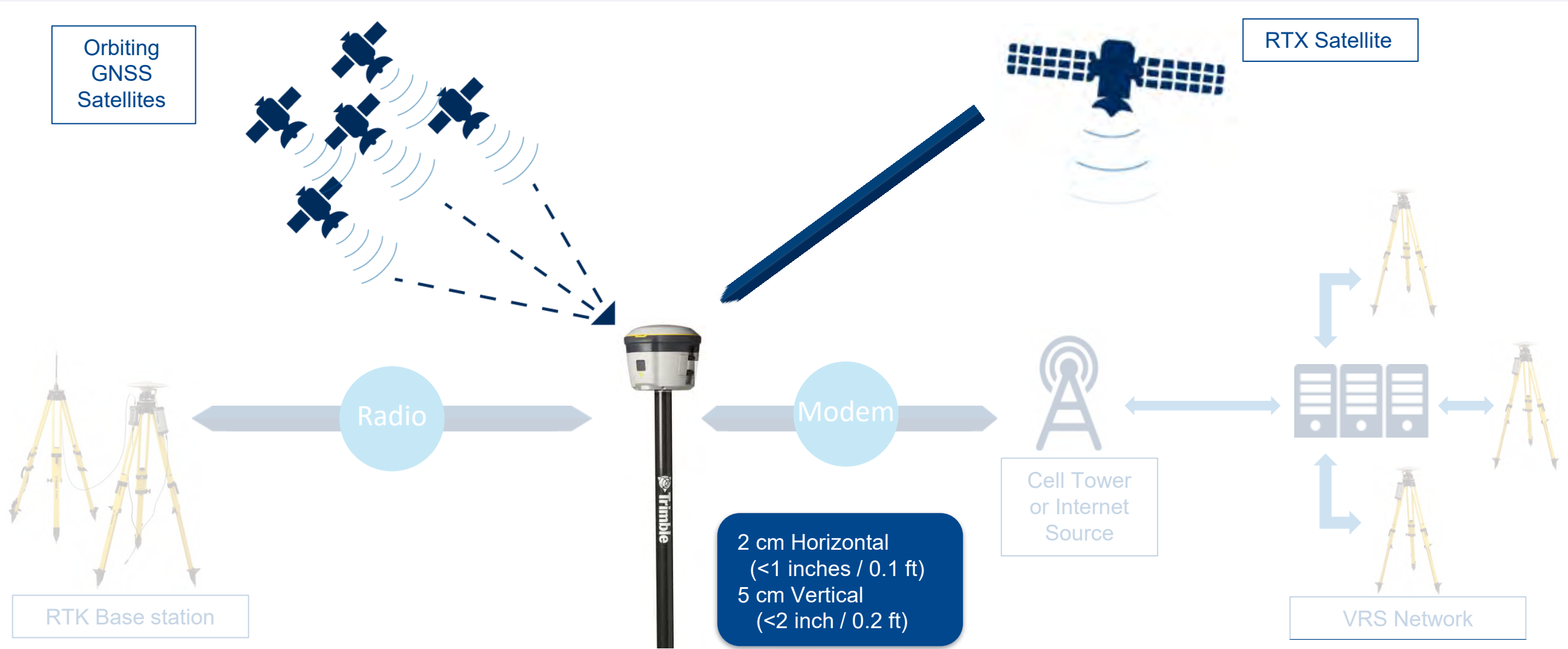
Trimble RTK

Centimeter-level accuracy within range of a base station



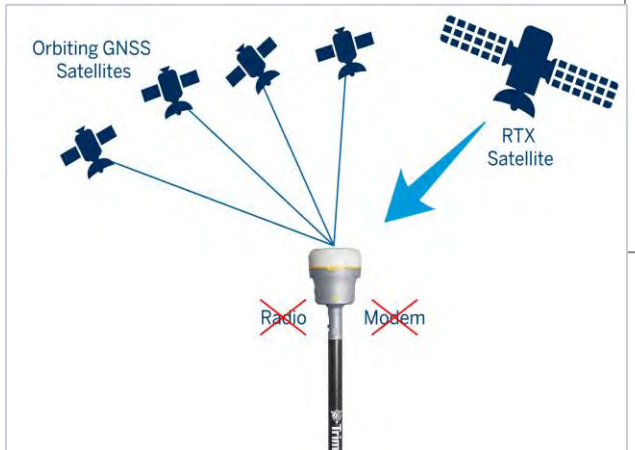
Trimble RTX

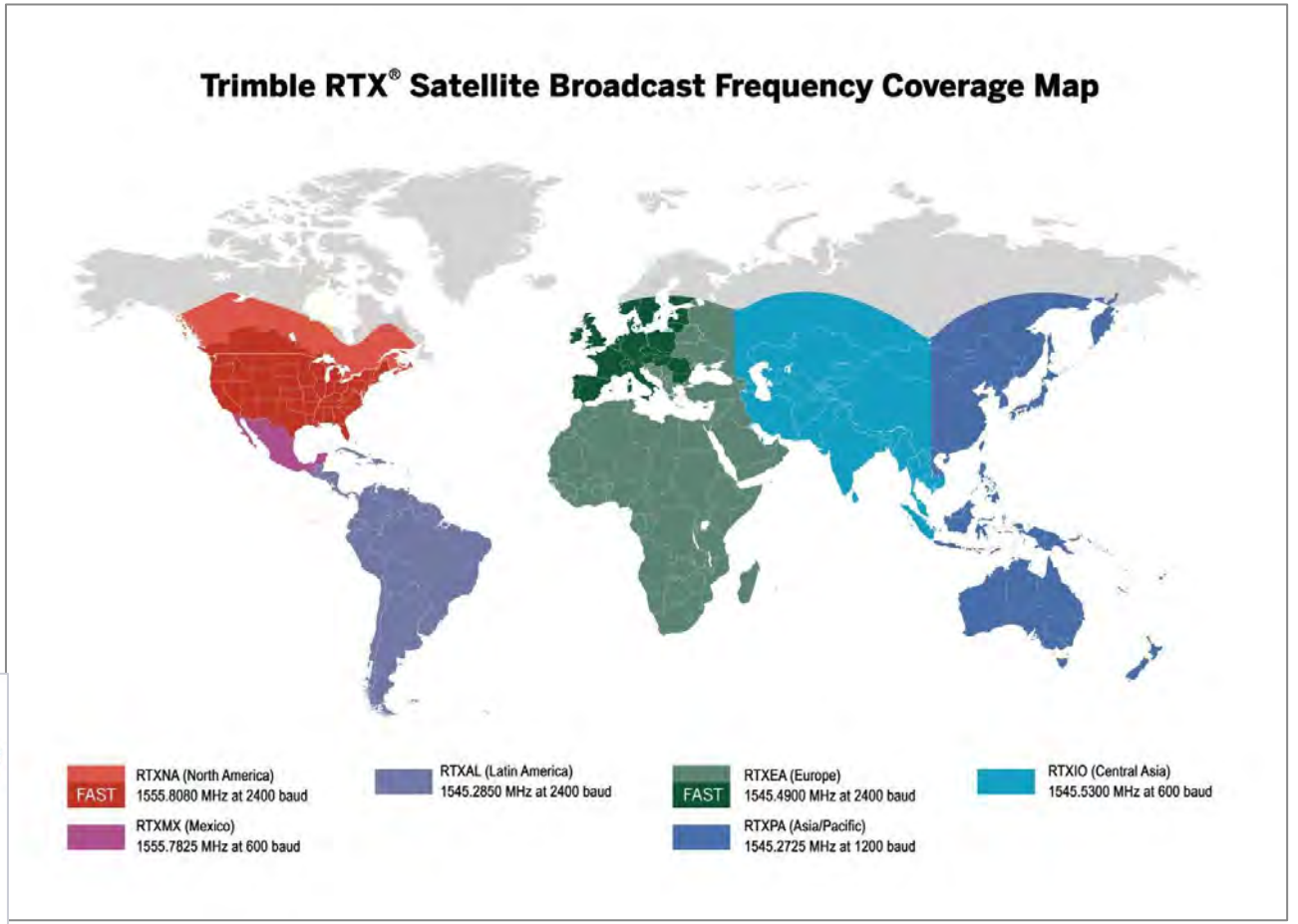
High-accuracy GNSS/GPS positioning - CenterPoint RTX



Worldwide Trimble RTX Satellite Coverage

- Absolute positioning (PPP) high centimeter level accuracy anywhere in the world, true global positioning technology
- Multi-GNSS positioning system
- Satellite delivered correction, also available via IP/cellular
- No base station required





IP Coverage anywhere an internet connection is possible

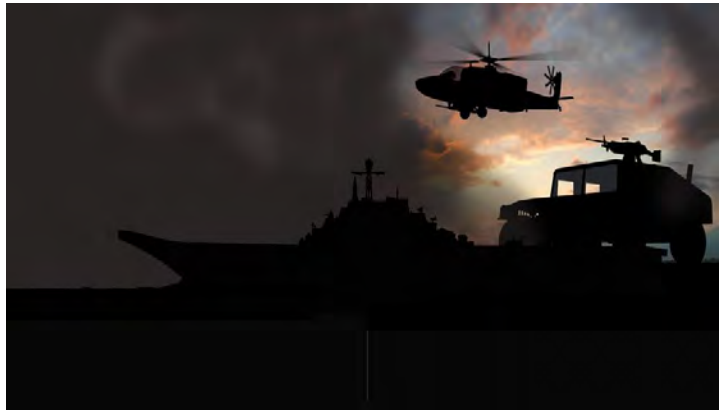
APPLICATIONS

Industry Focus

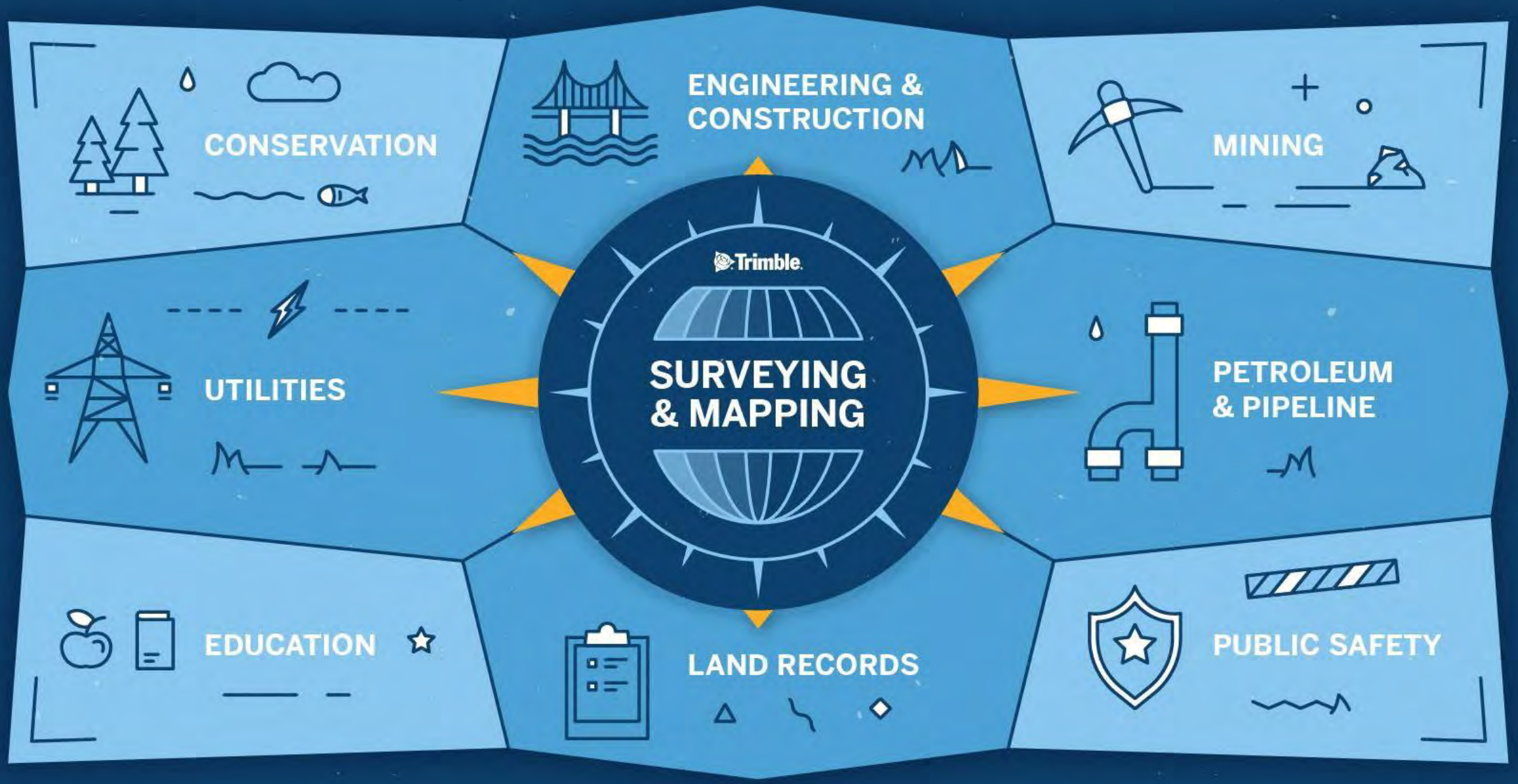
Land Administration

Transport & Infrastructure

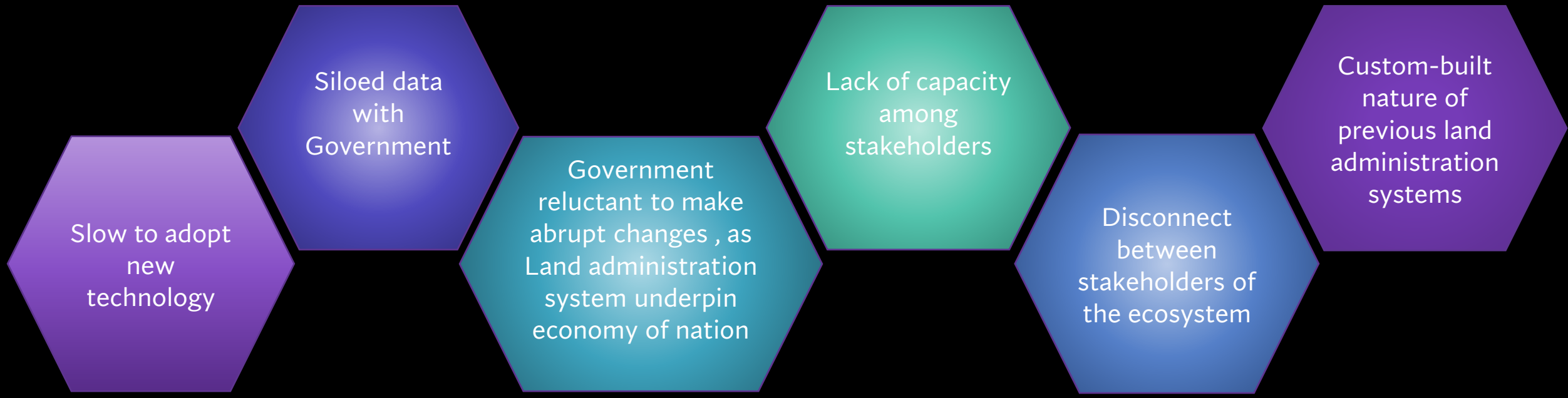
Logistics and Supply Chain



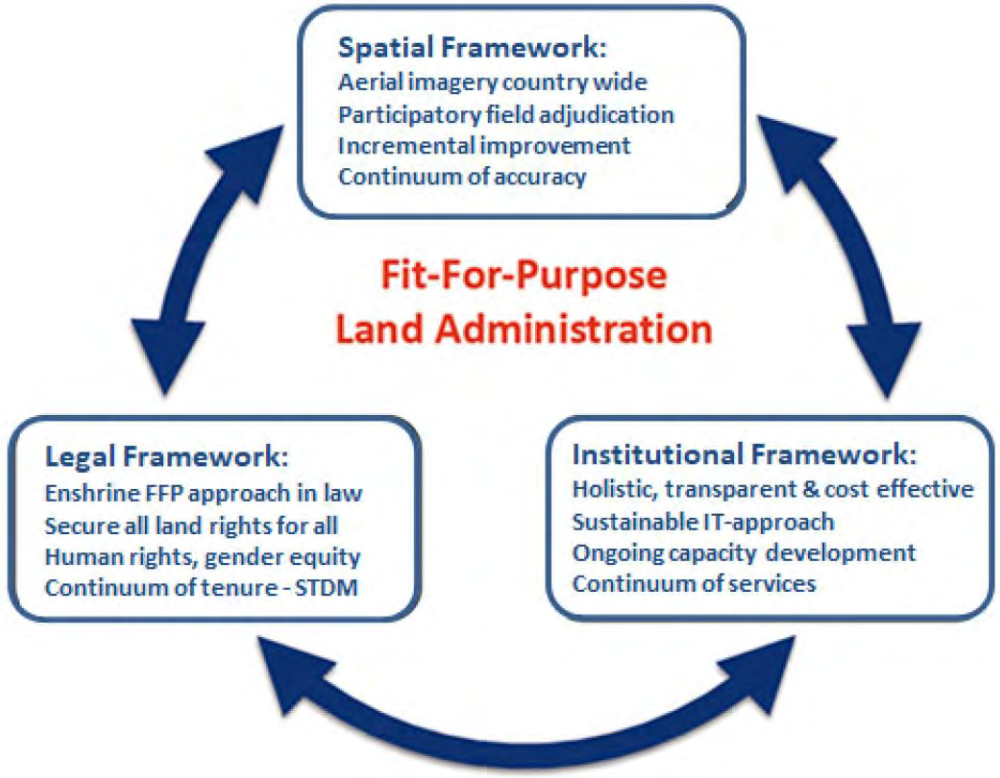
Public Safety and Security


CONSERVATION
ENGINEERING & CONSTRUCTION
MINING
Trimble
SURVEYING & MAPPING
UTILITIES
PETROLEUM & PIPELINE
EDUCATION
LAND RECORDS
PUBLIC SAFETY

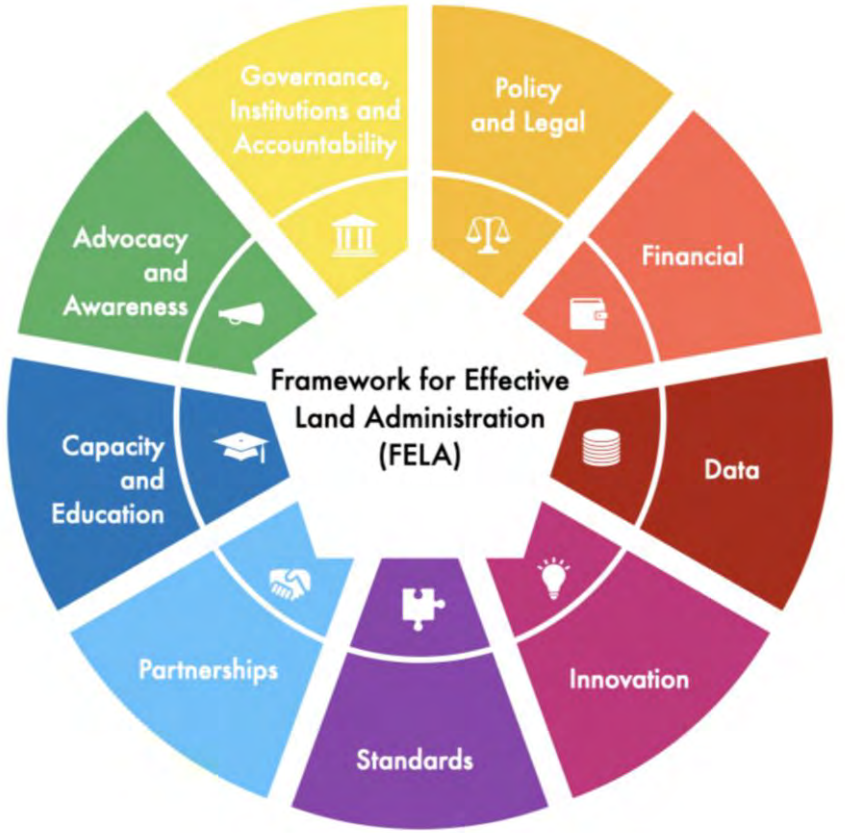
CHALLENGES IN LAND ADMINISTRATION



TRENDS IN LAND ADMINISTRATION



FIT-FOR-PURPOSE LAND ADMINISTRATION (FFPLA)



FRAMEWORK FOR EFFECTIVE LAND ADMINISTRATION (FELA)

Revolutionary GNSS Technology

Trimble DA2

Catalyst Service
- GNSS positioning (ProPoint)
- Trimble Corrections Hub
- Scalable from 1cm to 60cm
- Pay per hour, mth, or year

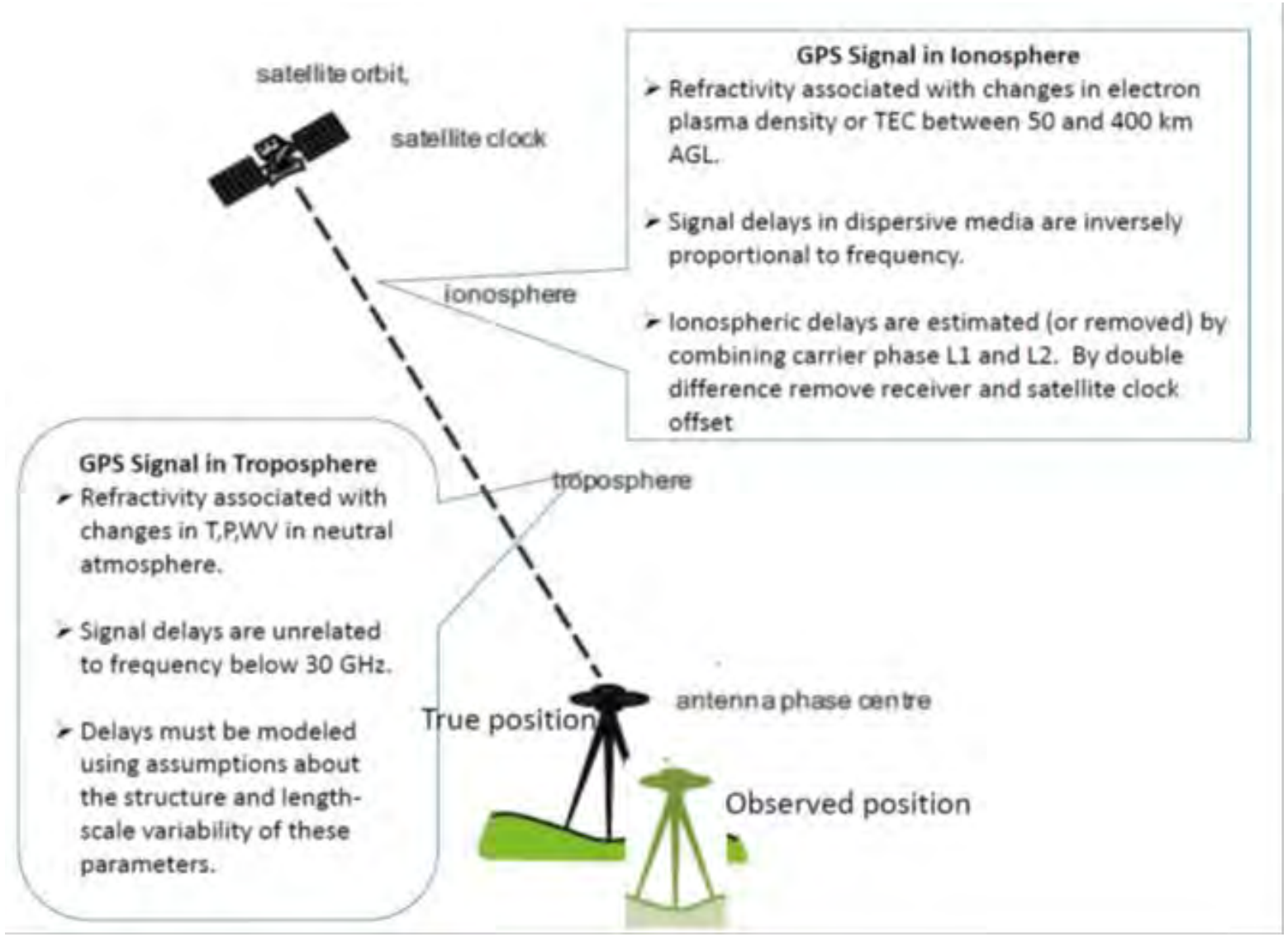
Android / iOS Mobile Device
(e.g. Trimble TDC600)

Mobile App
(e.g. Trimble or 3rd Party)

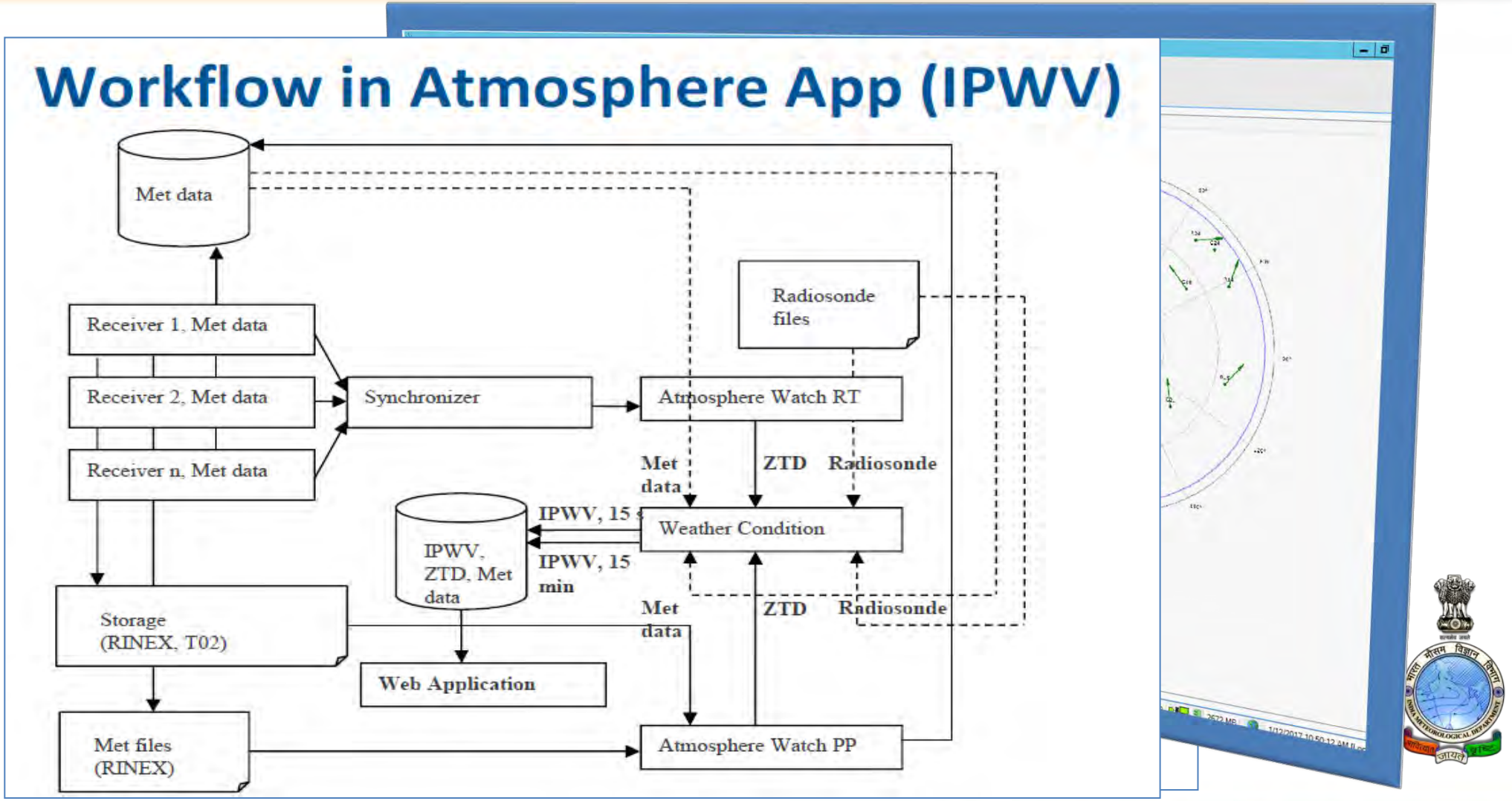
For Individuals

- Low start up cost
- Subscription based
- Flexible accuracy
- Leverage current mobile devices/apps
- Ideal for project or seasonal work
- Manageable monthly, annual or hourly cost
- Change or cancel the subscription at any time

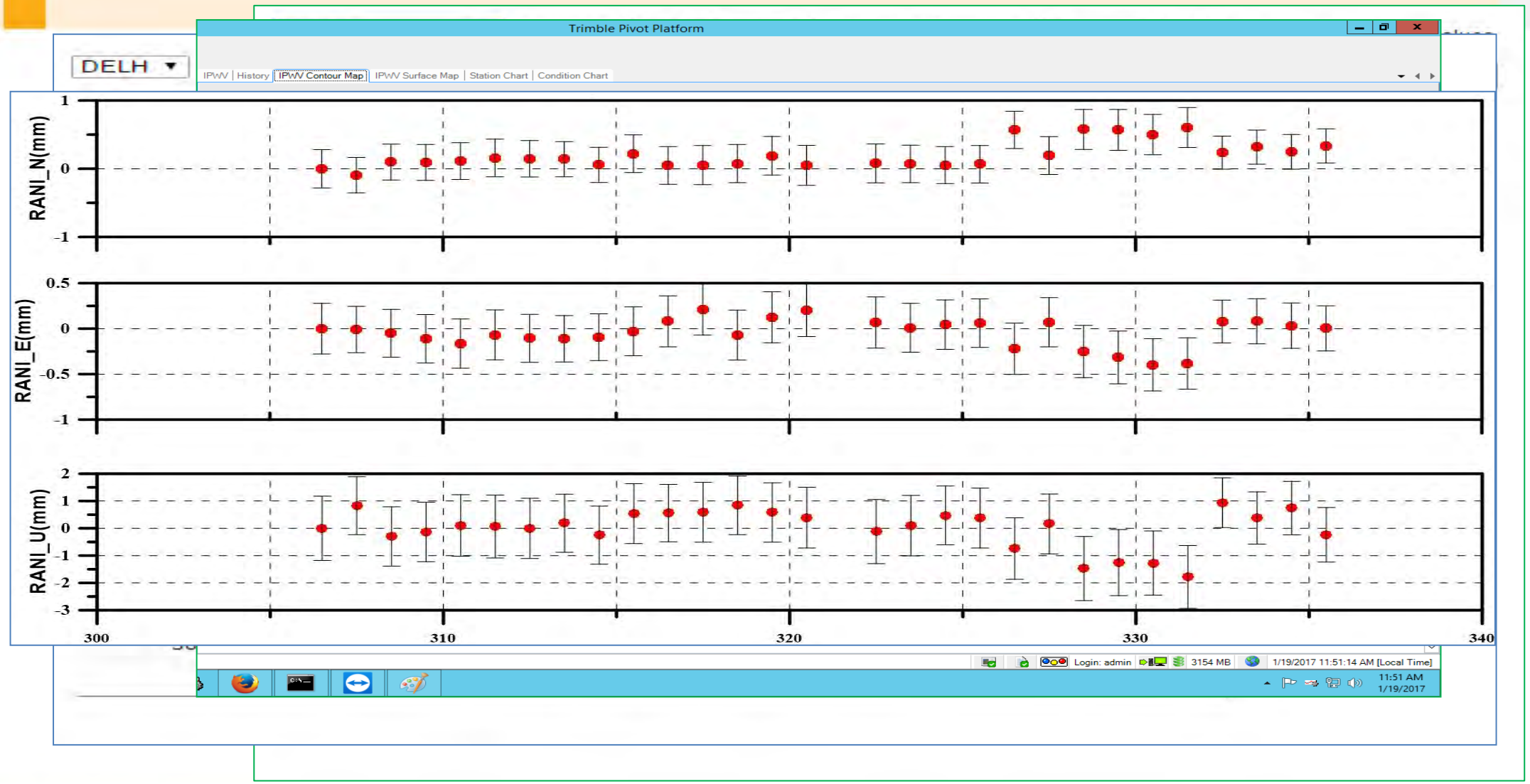
GNSS CORS FOR ATMOSPHERIC STUDIES



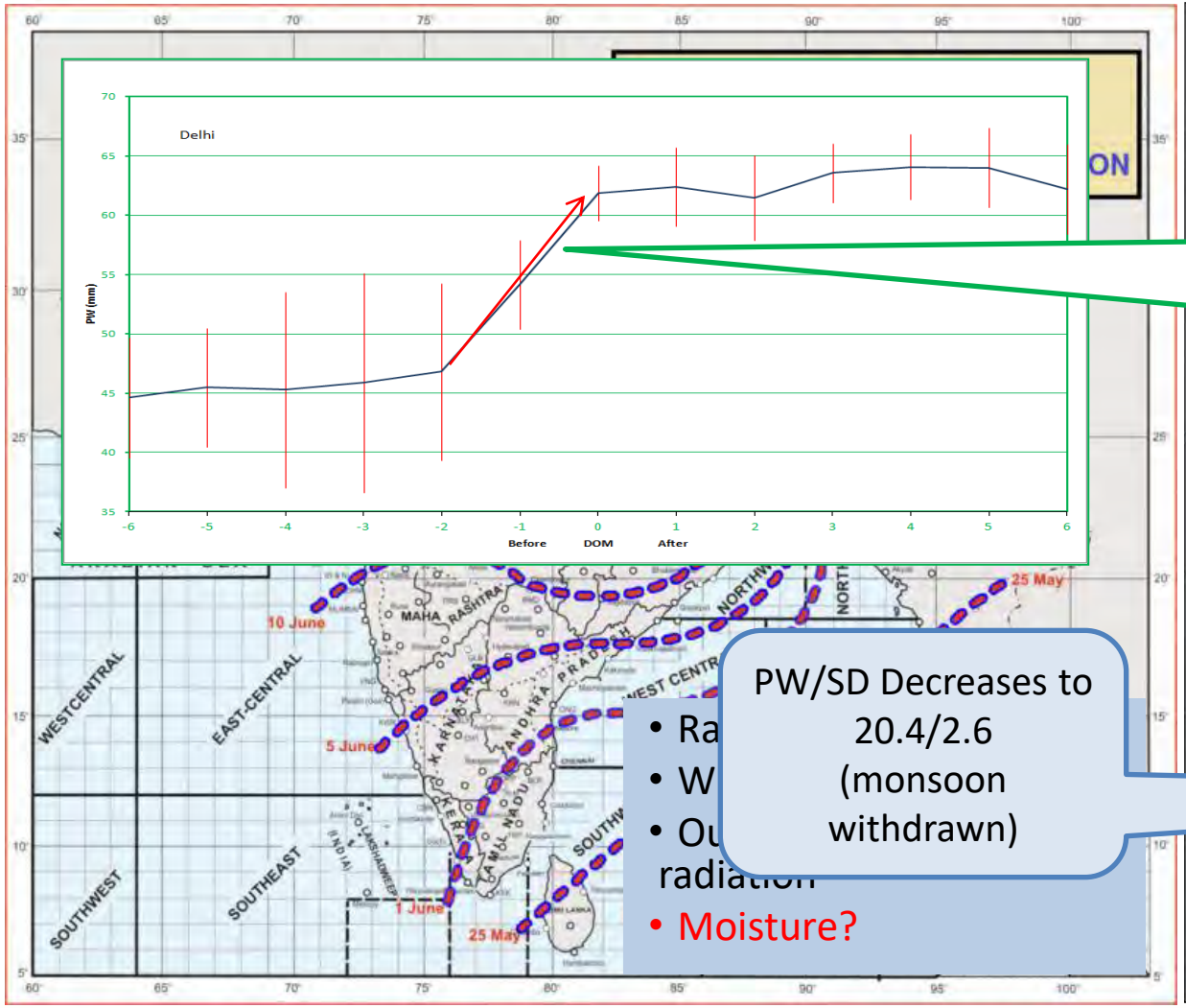
Communication – Broadband, Failover GPRS Data workflow for PW



IPWV in real time

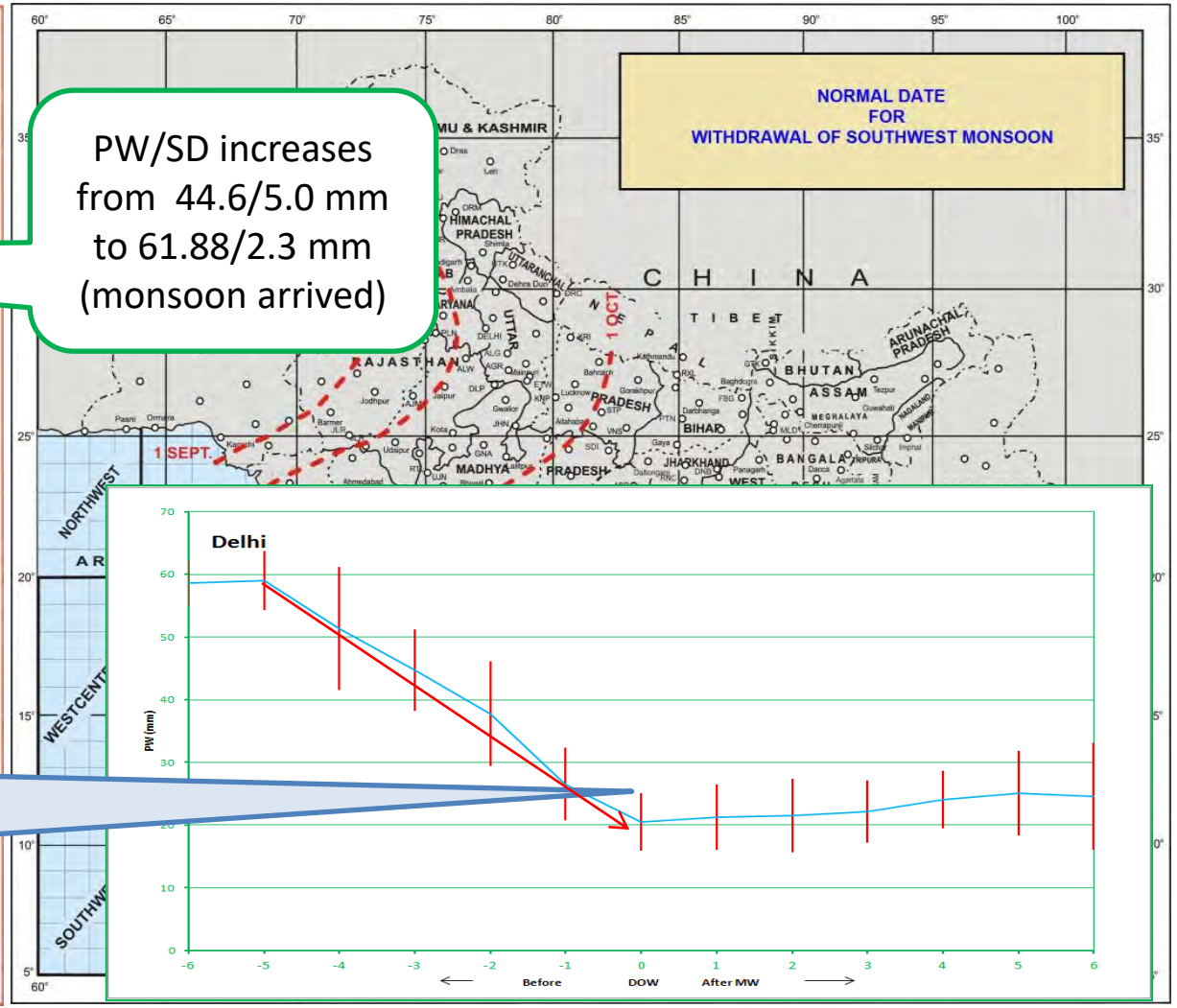


Progress and Withdrawal of Monsoon from GNSS PW



PW/SD increases from 44.6/5.0 mm to 61.88/2.3 mm (monsoon arrived)

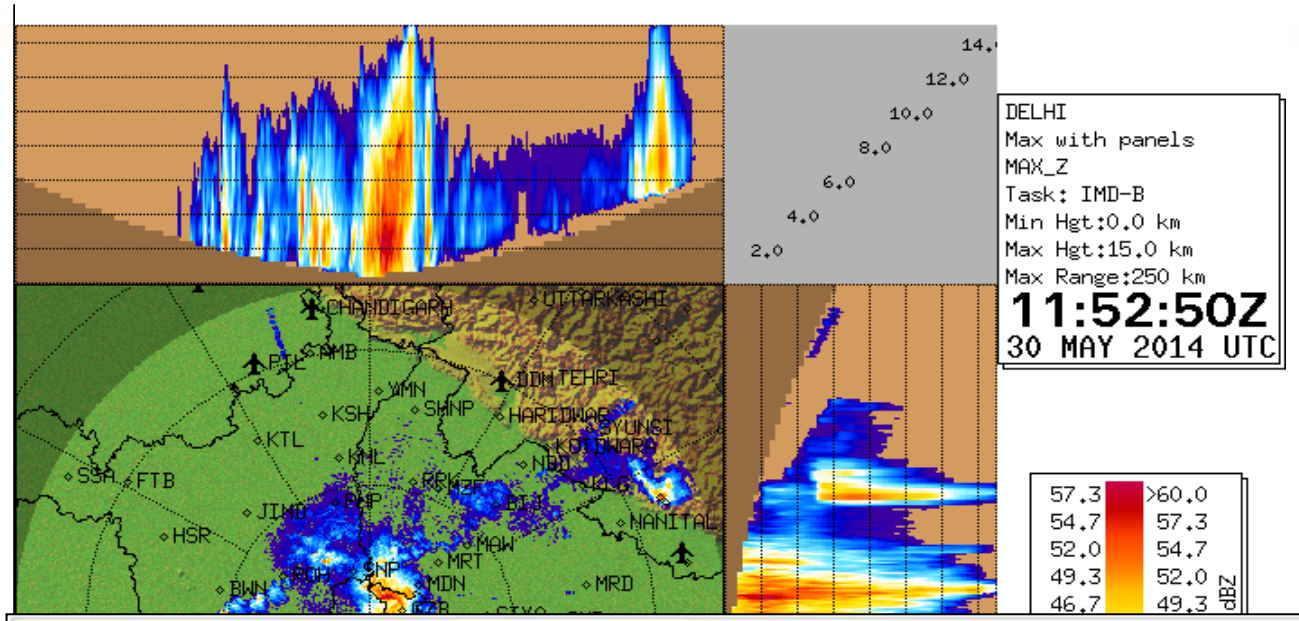
PW/SD Decreases to 20.4/2.6 (monsoon withdrawn)

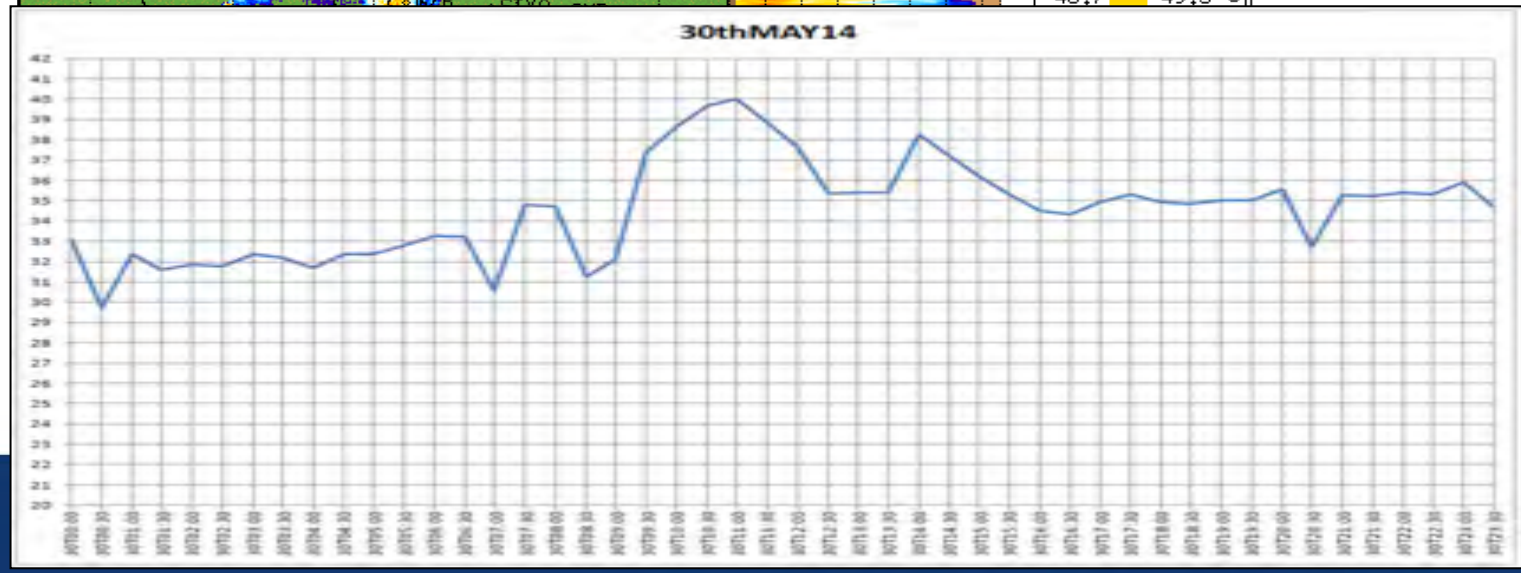


Source: http://www.imd.gov.in/

Over Estimation of Rainfall – Inference from PW

The satellite imageris showing convective thunder storms over Delhi region. The Doppler Radar also showing high reflectivity corresponds to heavy rainfall. But no rain.The GNSS IPWV showing only slight change in Value. GNSS proved that the amount of moisture present in the atmosphere is not sufficient for heavy rainfall.





Geodetic monitoring

Geodetic monitoring

Data acquisition

Geodetic sensors Trimble

On site

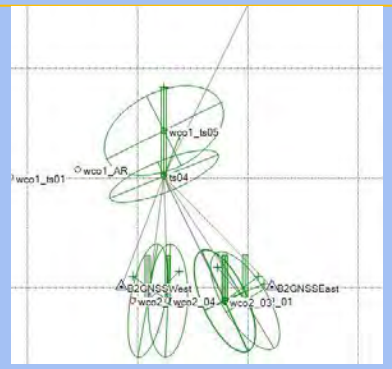
Data processing

Trimble 4D

Geodetic sensors

GNSS
Post processing engine

Total station
Resection



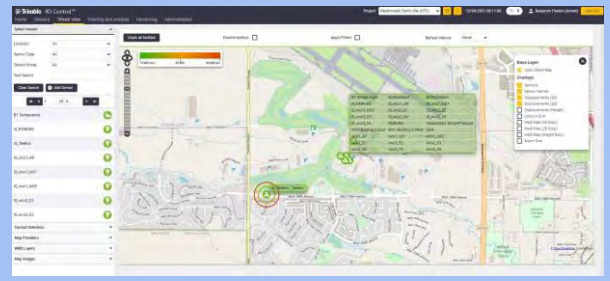
Server or local computer

Data visualization

Trimble4 D

Geodetic & Geotechnical sensors

Same visualisation platform for all the sensors



Server or local computer

Integrated Survey

Trimble 4D Control

Road Transportation

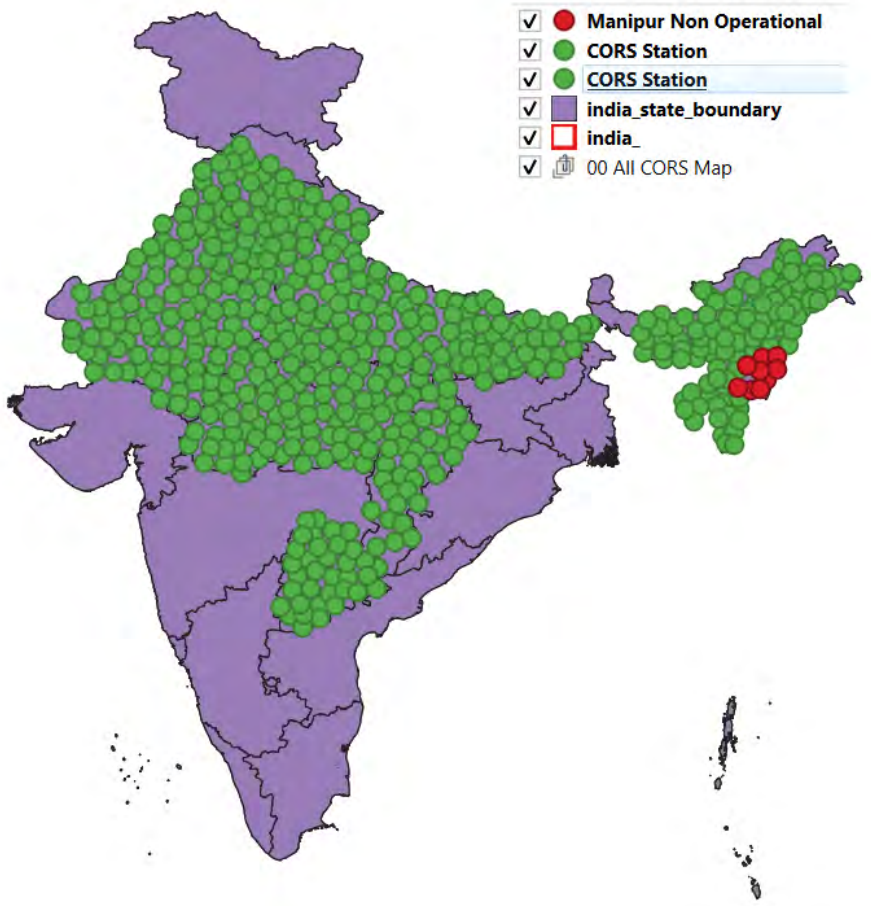
CASE STUDIES

CORS INFRASTRUCTURE INDIA

High Accuracy Positioning Infrastructure through CORS in India by Survey of India 1000++ Across the Country

523 CORS from Trimble
60 CORS by Trimble for Rail
02 Fully Functional Control Centre

[India CORS]



1. Survey /Resurvey in most of states using CORS
2. Live validation of Property documents
3. Asset Survey
4. Creating Road Infra
5. Co-seismic and Post Seismic Displacement Studies in Himalaya region and A & N
6. The CORS at Joshimath India was used to monitor the subsidence taking place .
7. Positioning to Drones in all states
8. Positioning to High Speed Rail Setup
9. Route Guidance system

CORS in SAARC

Thank You!

Subhash Kumar
Trimble Advanced Positioning RTN & Services
Subhash_kumar@trimble.com
Mob:+918978500887