Optimisation of Traffic Management and Traffic Telematics by multifunctional GNSS Services

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Introduction

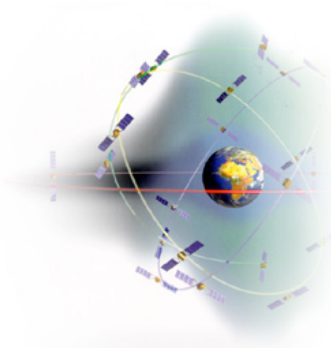
- Requested in traffic are
  - better use of existing infrastructures
  - decreasing of emissions
  - increasing safety in traffic
- The most measures in traffic need spatial referenced information, e.g. navigation, guiding, traffic management and information, fleet management
- Different traffic applications need different qualities of accuracy and guaranteed availability
- For a lot of positioning applications in the field of traffic local DGNSS reference stations (in the sense of GALILEO) are needed
- Only widespread spacious compatible solutions would be successful because of economical reasons

Global Navigation Satellite Systems

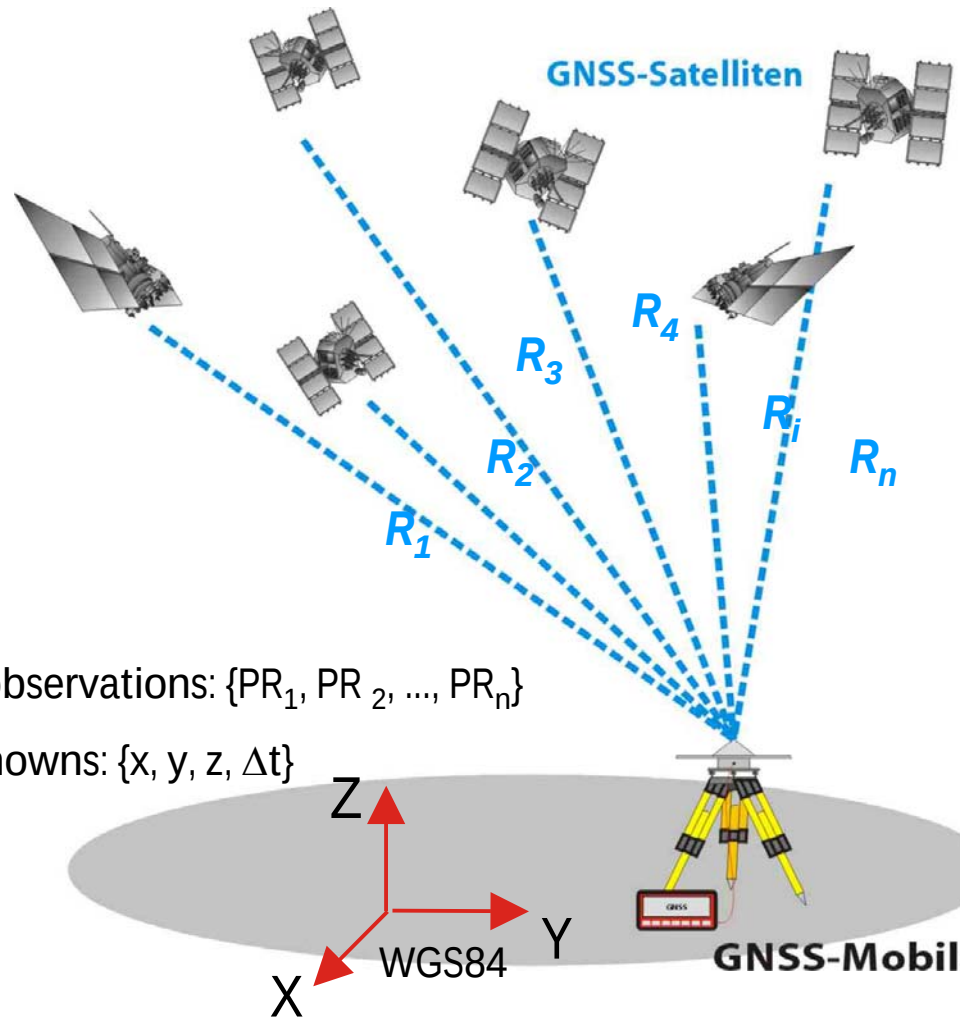
- Navigation Satellite Timing and Ranging - Global Positioning System (NAVSTAR - GPS) of the United States of America

- Global`naya Navigatsvannaya Sputnikovaya Sistema (GLONASS) of the Russian Federation

- Galileo of the European Union (complete functionality planned in 2008)



Basic principle of GNSS



n ≥ 4 observations: {PR_1, PR_2, ..., PR_n}

4 unknowns: {x, y, z, Δt}

GNSS-Genauigkeit (mittlerer Punktfehler):

$\sigma_P = PDOP * \sigma_I$

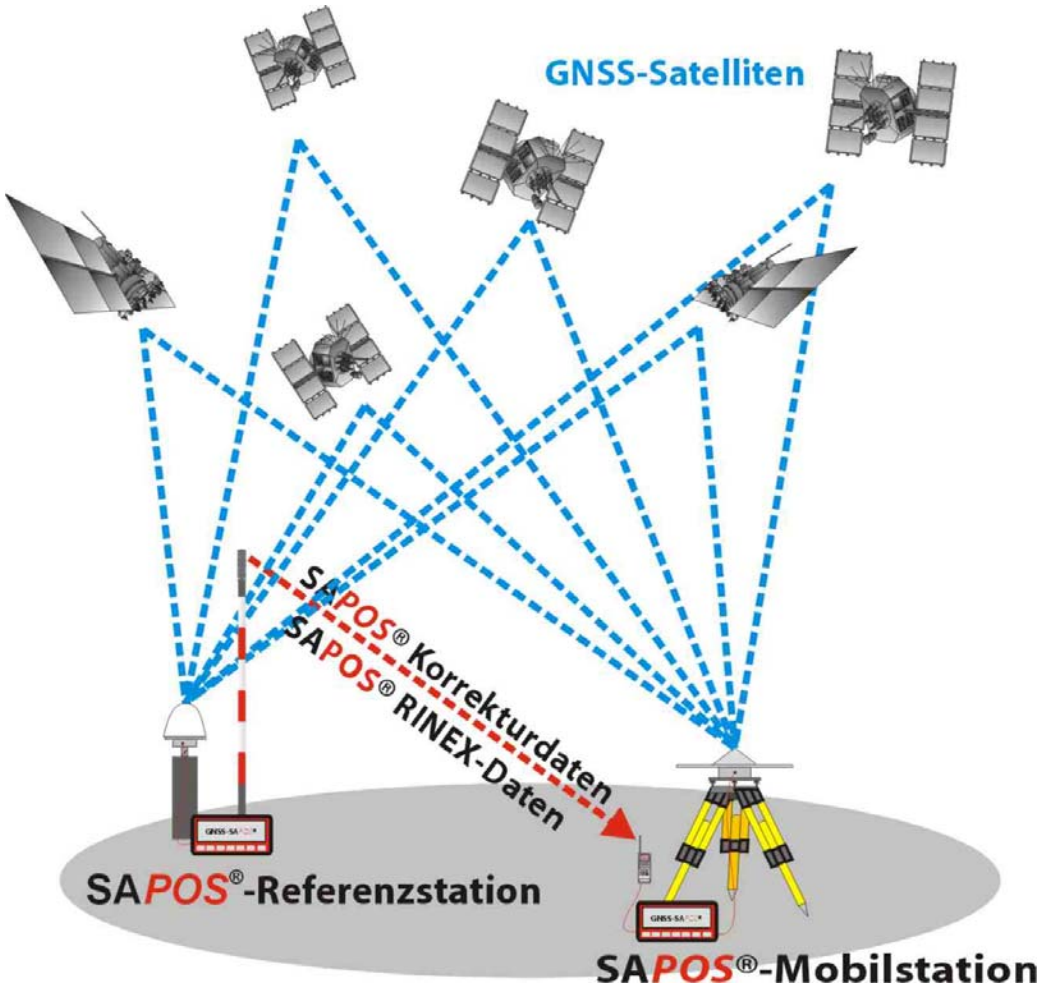
σ_I = standard deviation of pseudo ranges (Sum of all errors)

PDOP = Position Dilution of Precision (Geometry of the satellite configuration)

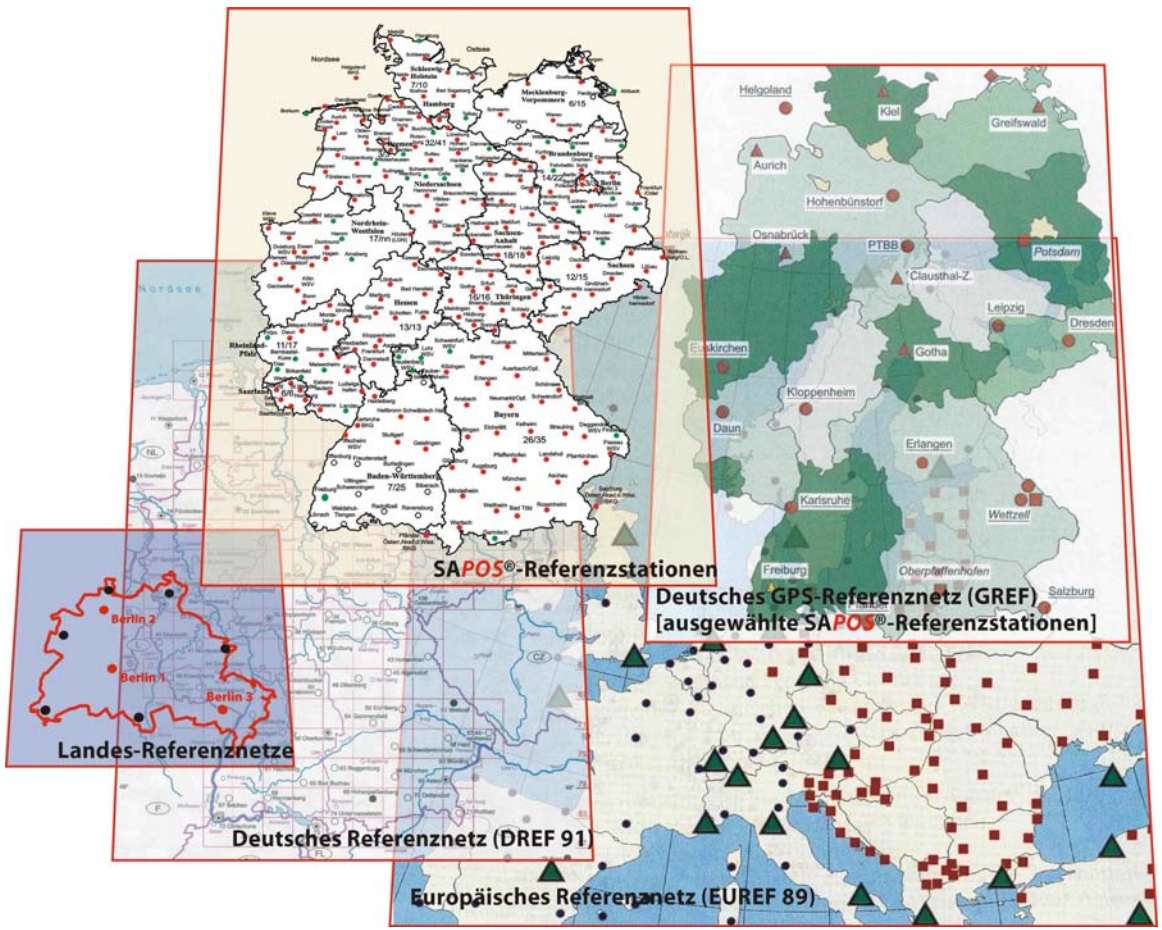
cm-accuracy only achievable by carrier phase measurements

systematic error influences!

Basic principle of DGNSS by EUPOS ®/SAPOS® etc.



European Terrestrial Reference System 1989 (ETRS89)



McDonald Laser Ranging Station in Texas (USA)
(source.: University of Texas)

Radio telescope Wettzell (Germany) (source: BKG)

The German SAPOS®

Aims of the German SAPOS®

- Area-wide permanent providing of a uniform homogenous spatial reference system (***European Terrestrial Reference System 1989 [ETRS 89]*** = official spatial reference system for EU, European-wide available and part of the world-wide realised International Terrestrial Reference System 1989 [ITRS 89])
- as a official basis infrastructure
- by modern techniques
- for all tasks of land surveying, cadastre/land registry and land management as well as
- for precise positioning, navigation and locating
- as a duty of the German surveying authorities.

SAPOS® GNSS correction data and observation data

SAPOS®Service	Availability	Media	Precision	Frequency	User interface
SAPOS® EPS	real-time	VHF/RDS, LW/RDS	1 - 3 m	3-5 s	RTCM 2.0
	real-time	VHF 2 m radio, GSM	0,5 - 2 m	1 s	RTCM 2.0
SAPOS® HEPS	real-time	GSM, VHF 2m radio, incl. networking	≤ 2 cm	1 s	RTCM 2.3 RTCM 3.0
SAPOS® GPPS	near real-time postprocess-ing	Internet	≤ 1 cm	1 s	RINEX 2.1
SAPOS® GHPS	postprocess-ing	Internet,	< 1 cm	1 s	RINEX 2.1

SAPOS® reference station framework

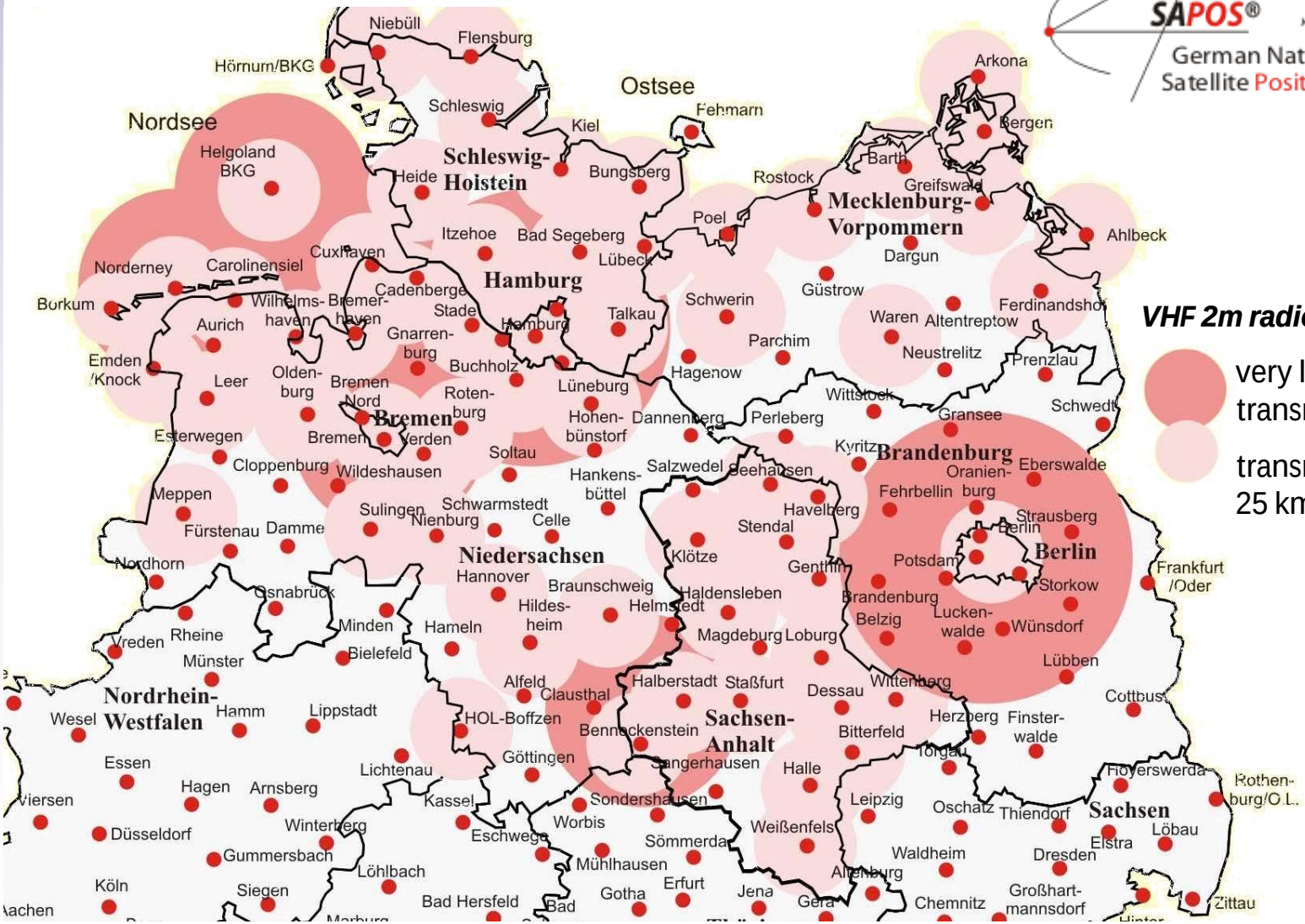
SAPOS®
German National Survey
Satellite Positioning Service

SAPOS® radio transmitters of the German public broadcasting stations

SAPOS®
German National Survey
Satellite Positioning Service

SAPOS® VHF 2m radio transmitters

SAPOS®
German National Survey
Satellite Positioning Service

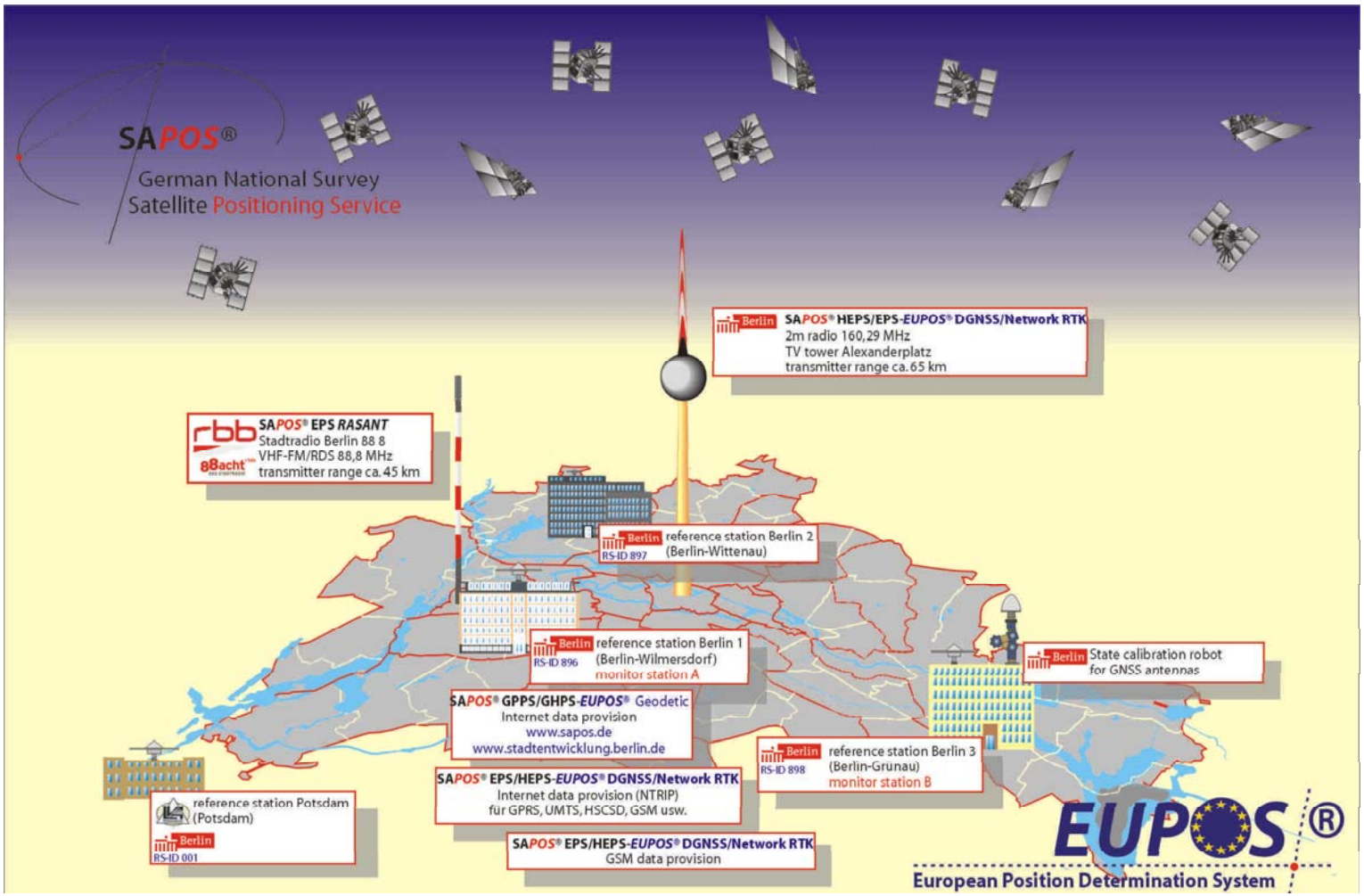


VHF 2m radio transmitter

very large transmitter range

transmitter range 25 km at least

Berlin EUPOS®/ SAPOS® reference station system



EUPOS® - an uniform DGNSS basis infrastructure

EUPOS

European Position Determination System

EUPOS® is supported by the UN Office for Outer Space Affairs

The organisatorial structure of EUPOS® - overview

International EUPOS® Steering Committee
Representatives of all member countries | Office

National EUPOS® Service Centres
EUPOS® provider, if not the same

Authorised EUPOS® resellers

EUPOS® users

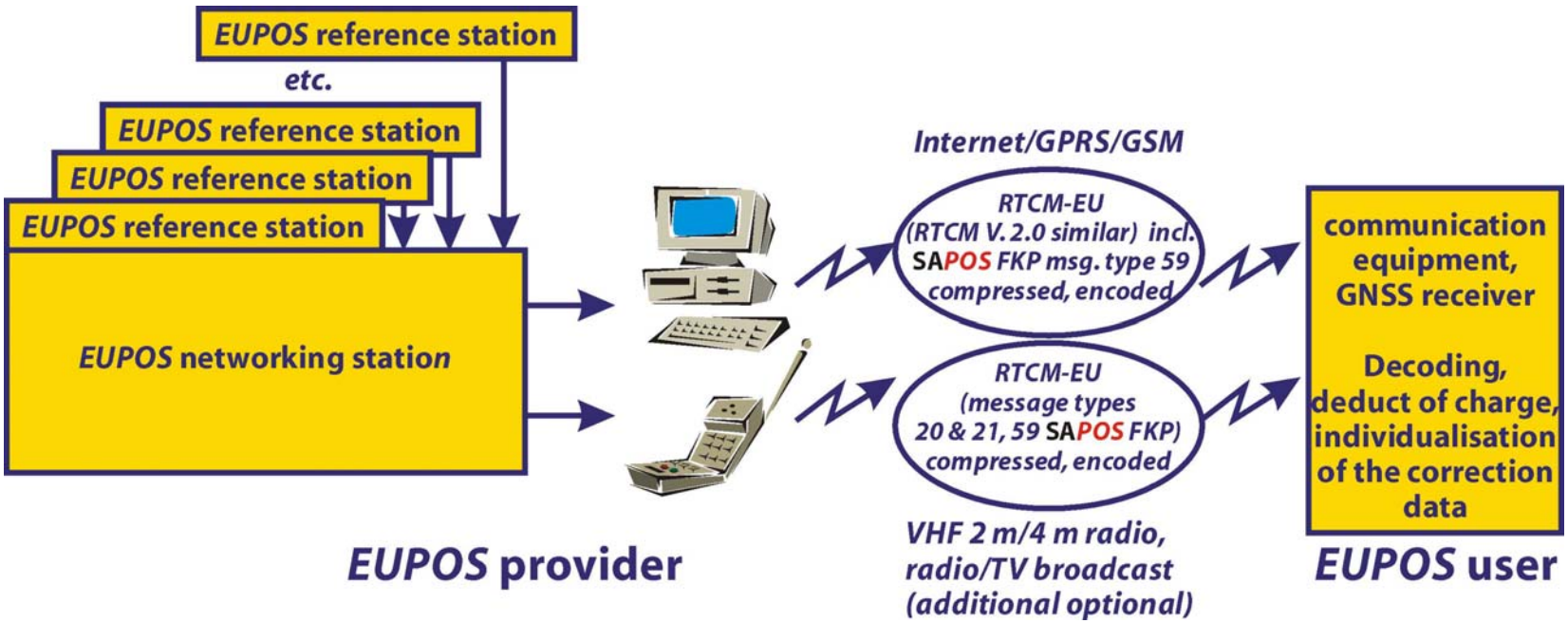
Manufacturers of EUPOS® compatible hardware and software

Resellers of EUPOS® compatible hardware and software

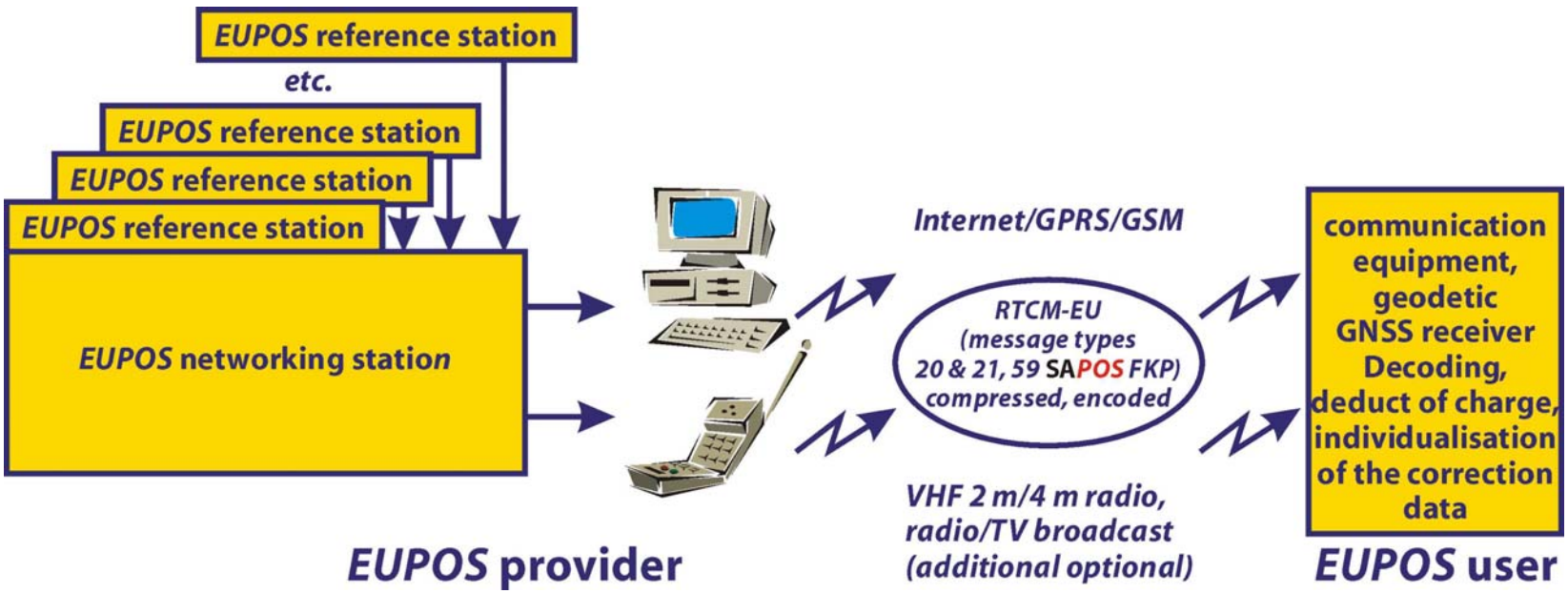
EUPOS® technical specifications

- uniform world-wide unlimited usable standards, guaranteed downward compatibility in cases of further development
- equal opportunities and investment security for the industry
- GALILEO (duty), NAVSTAR-GPS (option), GLONASS (option)
- strive for guaranteed availability of at least 99 % per annum
- standard medium internet for all sub-services
- optional media radio / broadcast for ***EUPOS®*** real-time sub-services

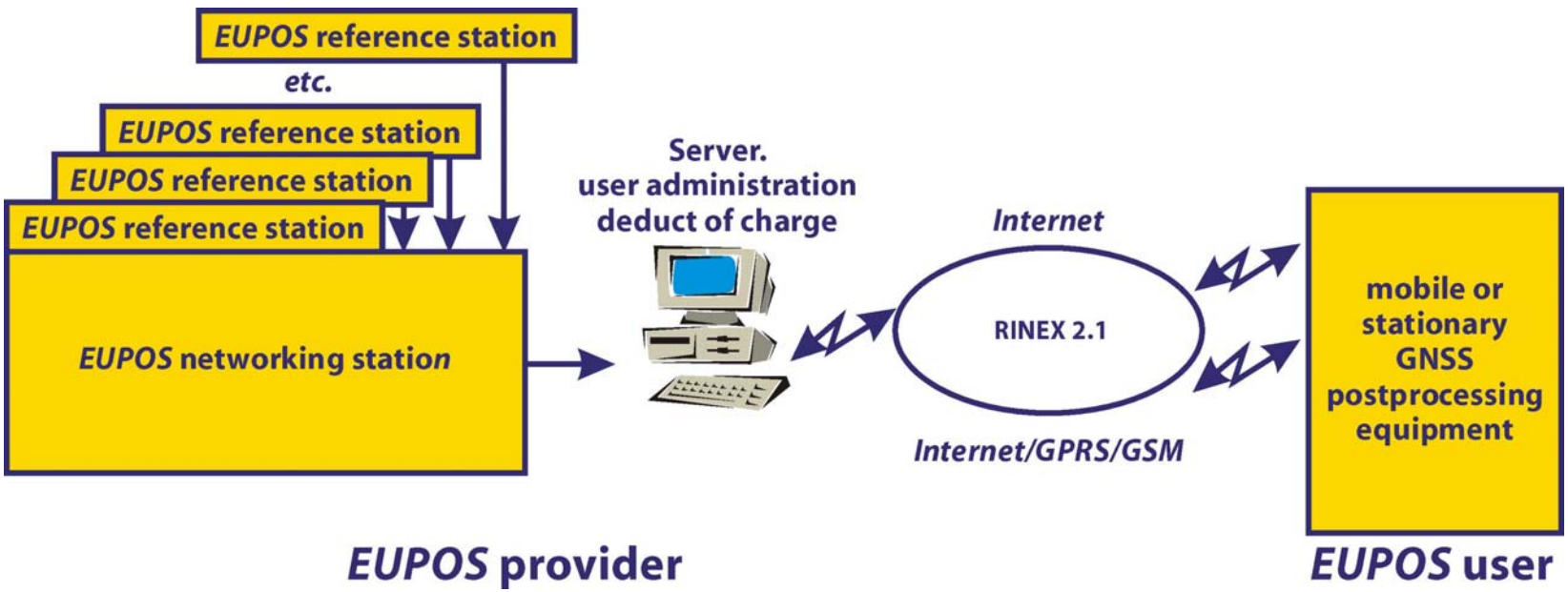
EUPOS® - sub-service EUPOS® DGNSS

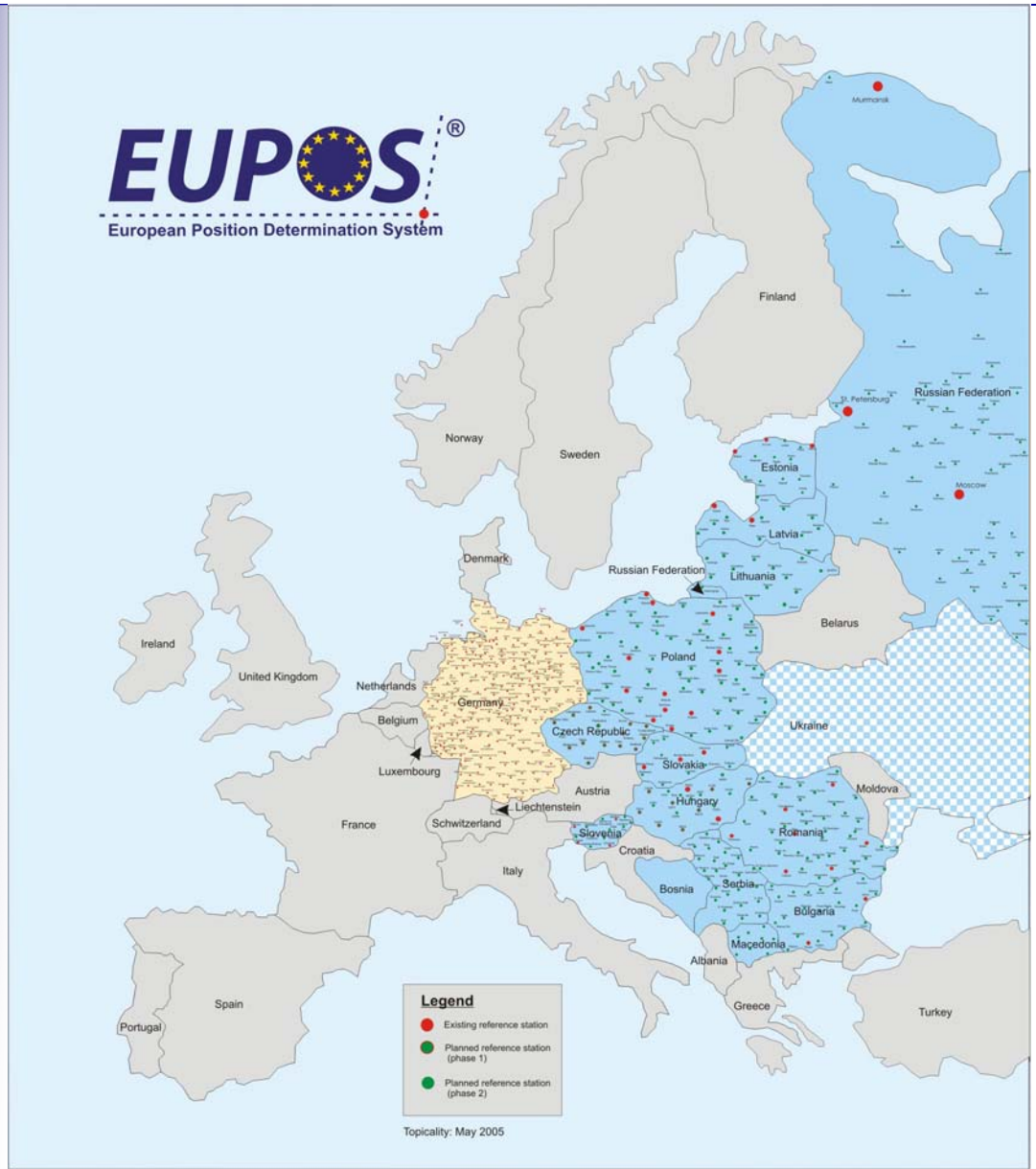


EUPOS® - sub-service EUPOS® Network RTK



EUPOS® - sub-service EUPOS® Geodetic

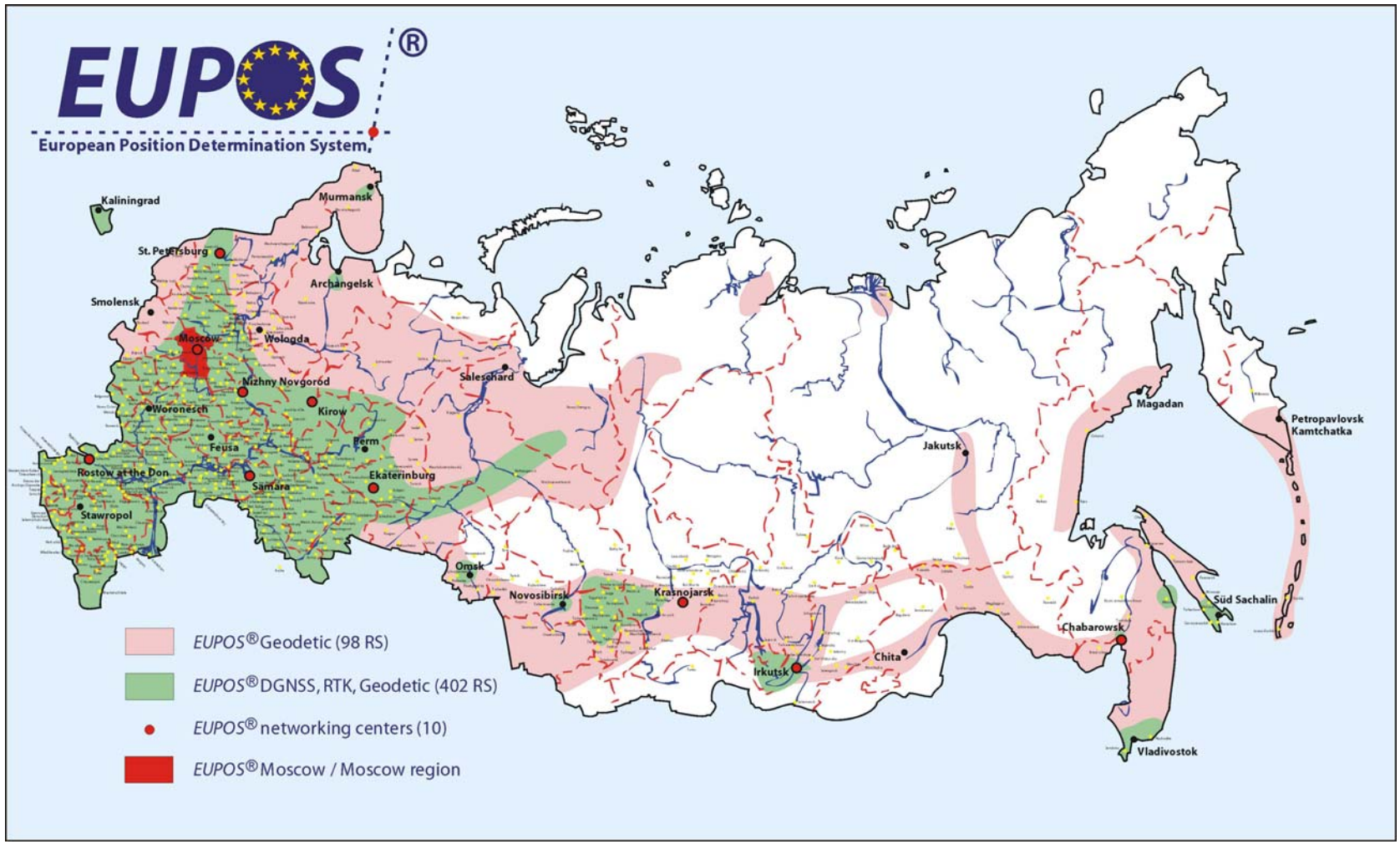




EUPOS planning and Member Countries

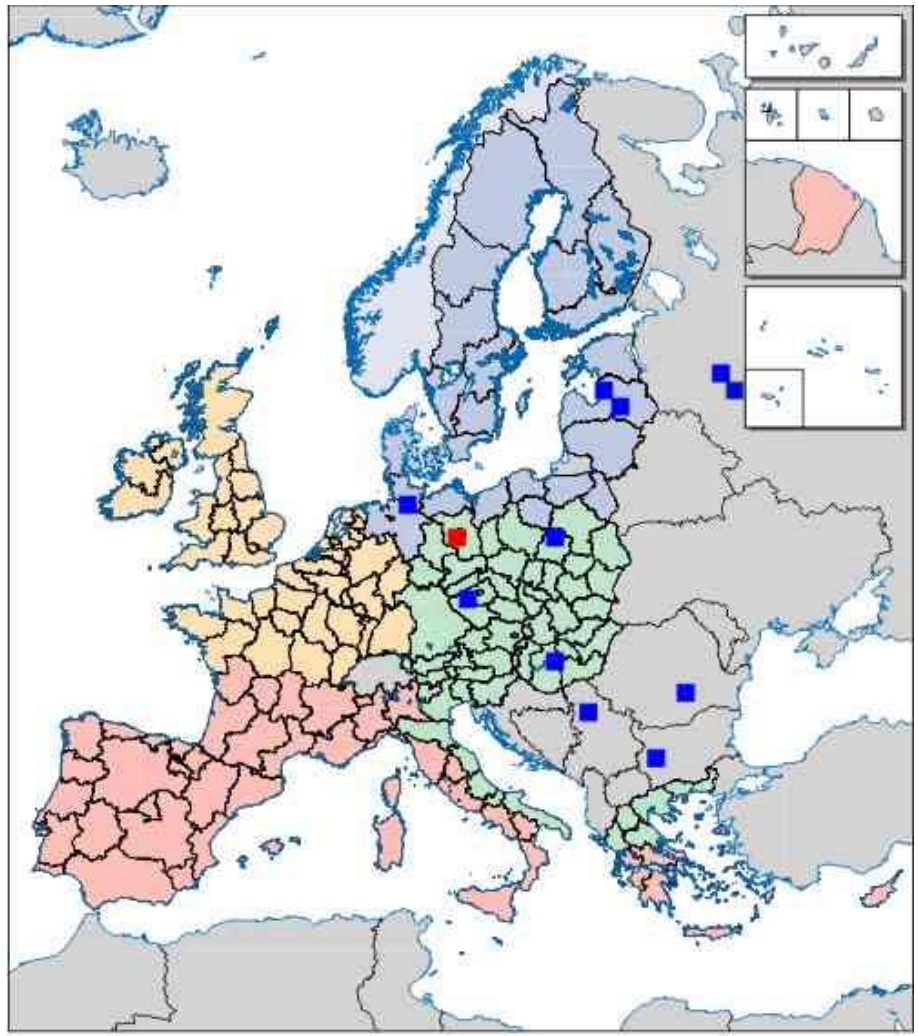
Bosnia and Herzegovina
Bulgaria
Czech Republic
Estonia
Hungary
Latvia
Lithuania
Macedonia
Poland
Romania
Russian Federation
Serbia and Montenegro
Slovakia
Slovenia
Berlin, Hamburg (consultative)
Ukraine (strives membership)

Russian EUPOS® planning

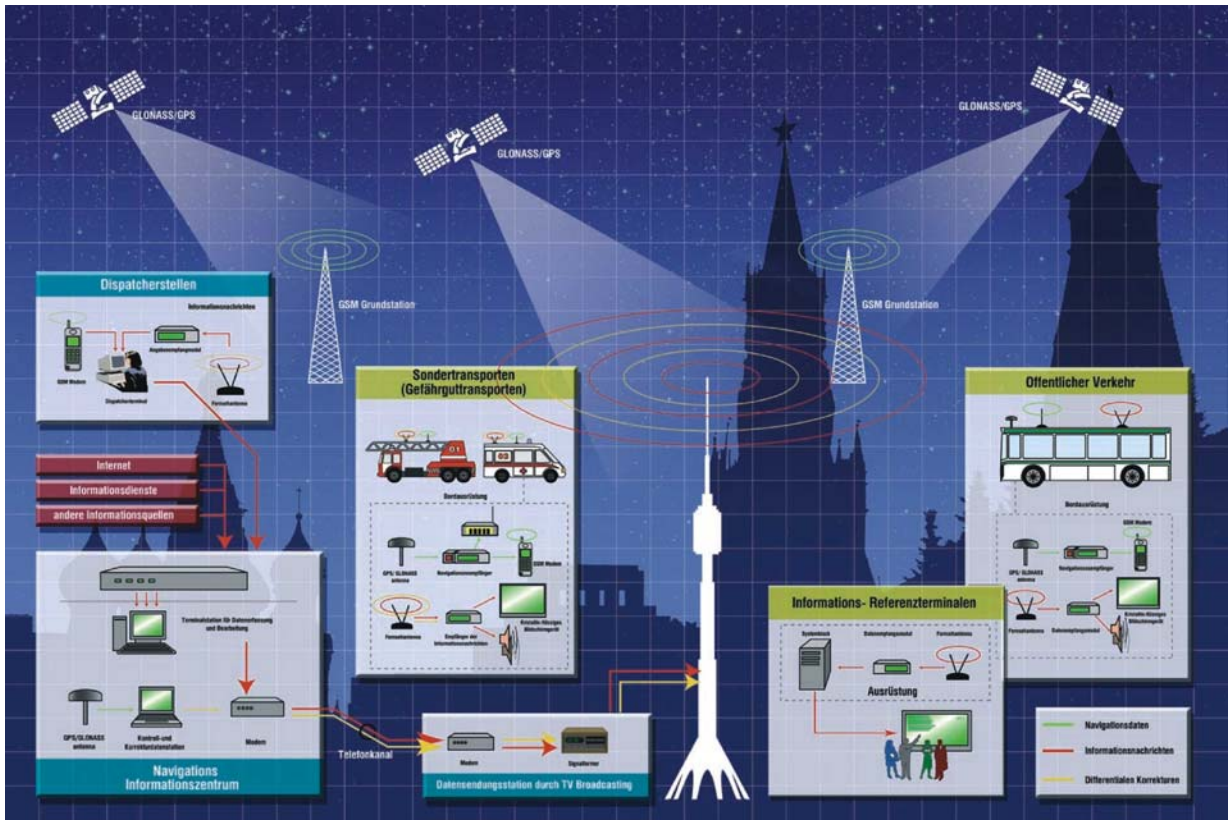


EUPOS – INTERREGIONAL COOPERATION
EU INTERREG III C East

Project of 12 Institutions from 9 Central and Eastern European Countries



The EUPOS® pilot project Moscow – Partnership of the capitals Berlin and Moscow



Verwaltung für Verkehr und Kommunikation Moskau

Föderales Staatliches Einheitsunternehmen Russisches Institut für kosmischen Gerätebau

Wissenschaftliches Produktionsunternehmen

AG Mobile Telematiksysteme für Positionierung

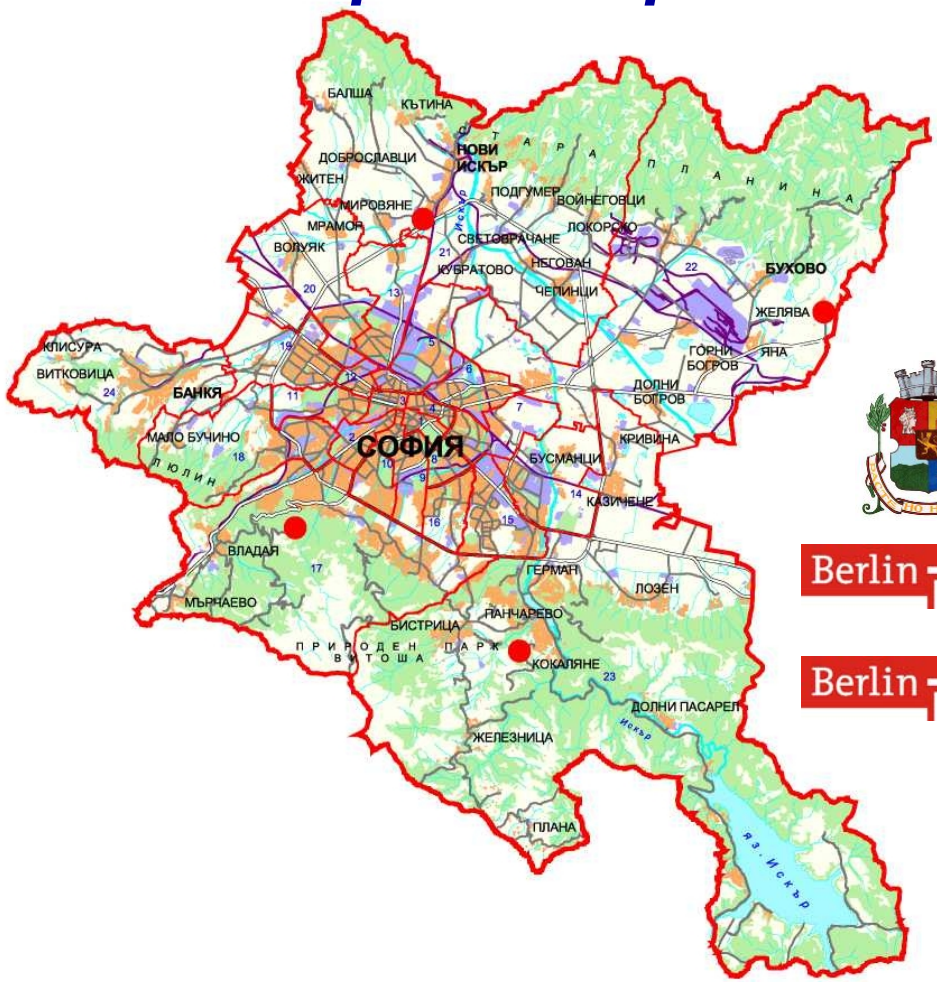
GIS - Geographische Informationssysteme GmbH

Senatsverwaltung für Stadtentwicklung Berlin

Siemens GmbH Mobile Information Kommunikation

Analytik Jena AG

The EUPOS® pilot projects - Partnership of the capitals Berlin and Sofia



Sofia Mayor Office

Berlin Mayor Office

Berlin Senate Department for Urban Development

Countries
that will support a uniform basis DGNSS infrastructure for navigation, position determination and locating are kindly invited to join the EUPOS® initiative

EUPOS®/SAPOS® applications in the field of traffic (examples)










Vehicle Scheduling and Control System of the Berliner Verkehrsbetriebe BVG

- punctuality, connection quality
- dynamic passenger information
- influence of traffic lights
- acceleration measurements
- flexible change of routes
- safety for passengers, drivers
- reduced costs

Central Police Traffic Service of Berlin (ZVkD)

State visitors, demonstrations, parades etc.

- Escorting of important state visitors
- flexible changes of routes
- precise traffic steering in time
- security measurements

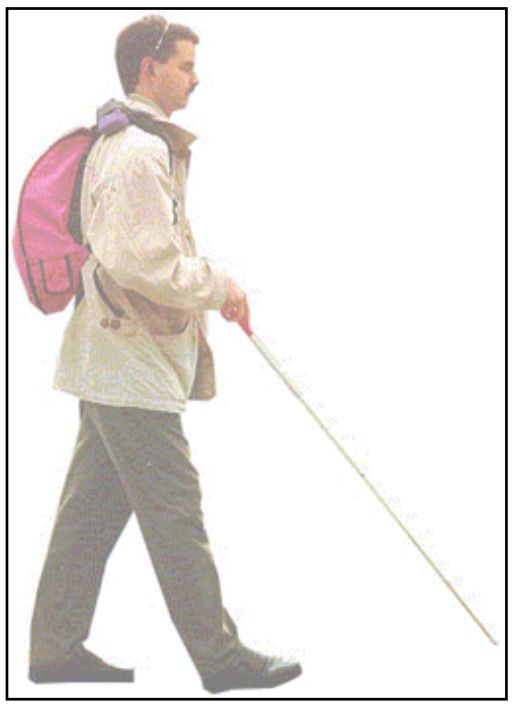
Foto: Berliner Polizei

Management of freight vehicles on large building sites

Rhenus Baulogistik GmbH
www.rhenus.de

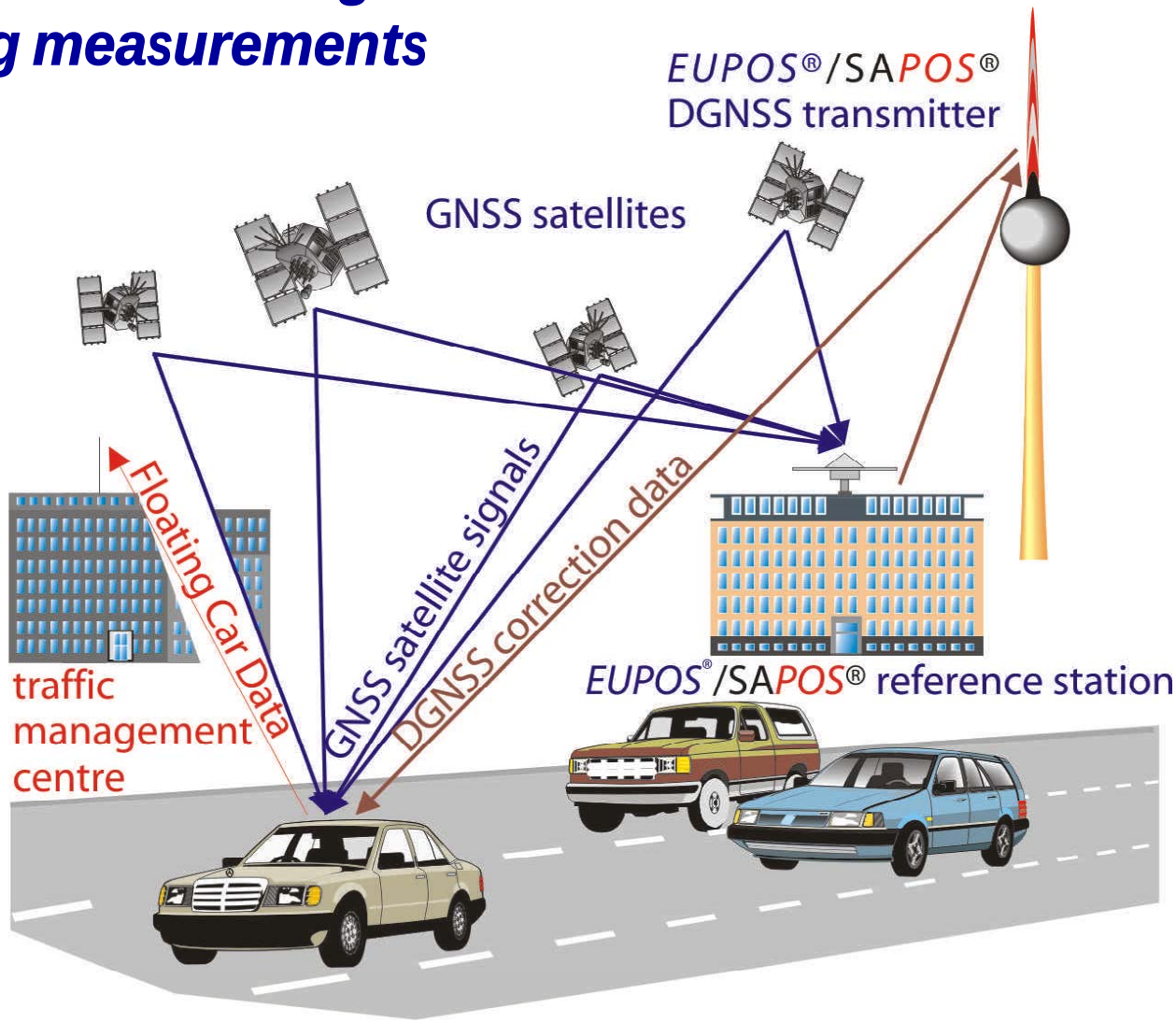
EU project Mobility for Blind and Elder People interaction with Computer

MoBIC



F.H.PAPENMEIER

Lane-precise Floating Car Data in real time for traffic steering measurements



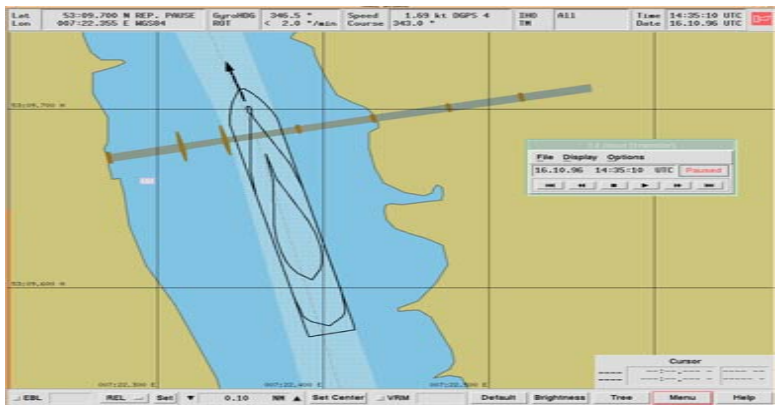
Autonomous fleet management and guiding system

MOFIS

Hamburg Fire Service

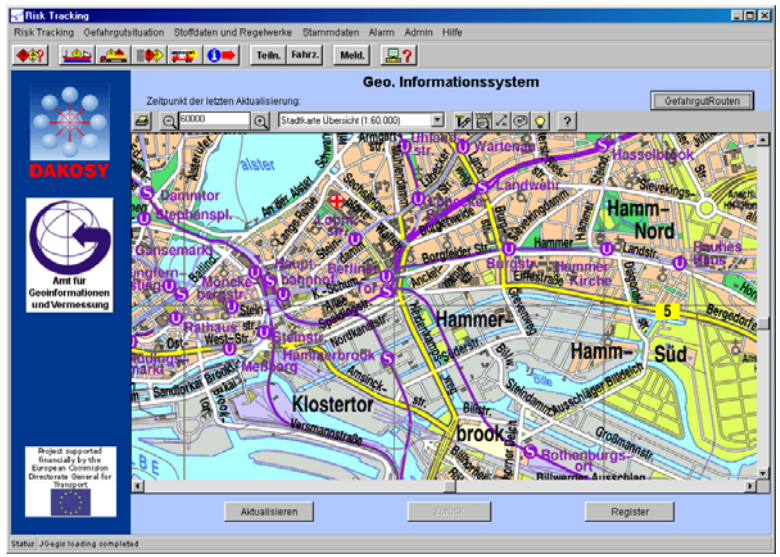
Meyer Werft Papenburg

Transfer of ocean liners after production at the river Ems into the deep fair-way of the North Sea



www.meyerwerft.de

Risk tracking – EU project VIKING

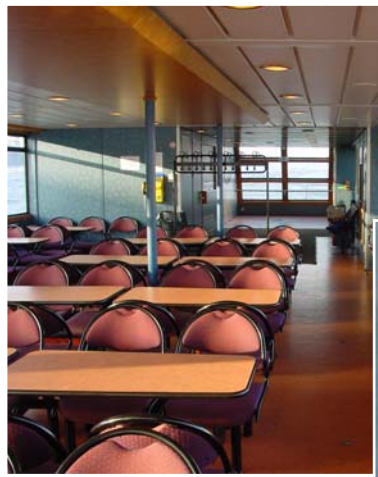


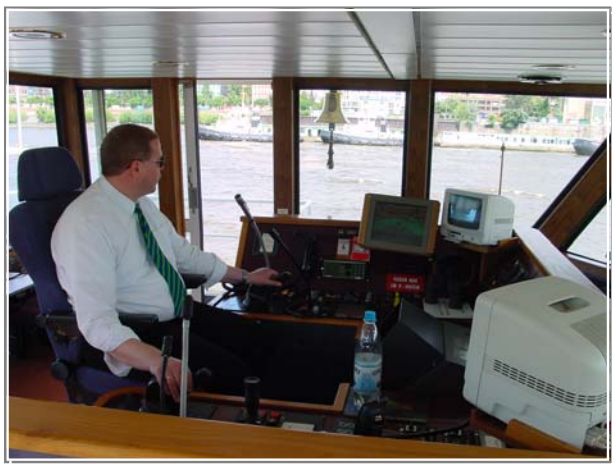
DAKOSY AG

VIKING

Geoinformation Vermessung

Dynamic passenger information system and precise positioning and navigation





HADAG

Hafen-Dampfschifffahrt-
Aktiengesellschaft
Hamburg

Dynamic passenger information system and precise positioning and navigation

photo: www.kreuzfahrt-reisen.de

Special missions, e. g.

- rescue helicopters (tested)
- safeguarding tasks (tested)
- measurements for radio/TV broadcast supply (field strength)

Precise starting and landing (tested)

Dynamic surveying of roadway – inclusion of traffic relevant data (e. g. road signs, possibilities to turn)

Conclusions

- The use of GNSS and DGNSS technologies is essential for economic and efficient position determination solutions
- It was reported about the ground-based uniform multifunctional DGNSS infrastructure ***EUPOS*** arising in Central and Eastern Europe, that fulfils also many demands of traffic
- Examples of applications and for the benefits were reported

Thank you very much for your attention!

Foto: Hirsch/Kläber