

Making GNSS-RTK Services Pay

Chris Rizos

*School of Surveying & Spatial Information
Systems, UNSW, Australia*

Jöel van Cranenbroeck

Leica Geosystems, Switzerland

GNSS Geodesy Legacy...

- Increased interest in establishment of high precision CORS networks
- Traditionally driven by Geodesy Apps...*from geodynamics to reference frame maintenance*
- Govt land/survey agencies are principal CORS operators...*but private sector ops increasing*
- Variety of DGNSS service provider models...*mixing public & private networks/operators*
- Trend to real-time data & services...
- **But can GNSS-RTK services make money?**

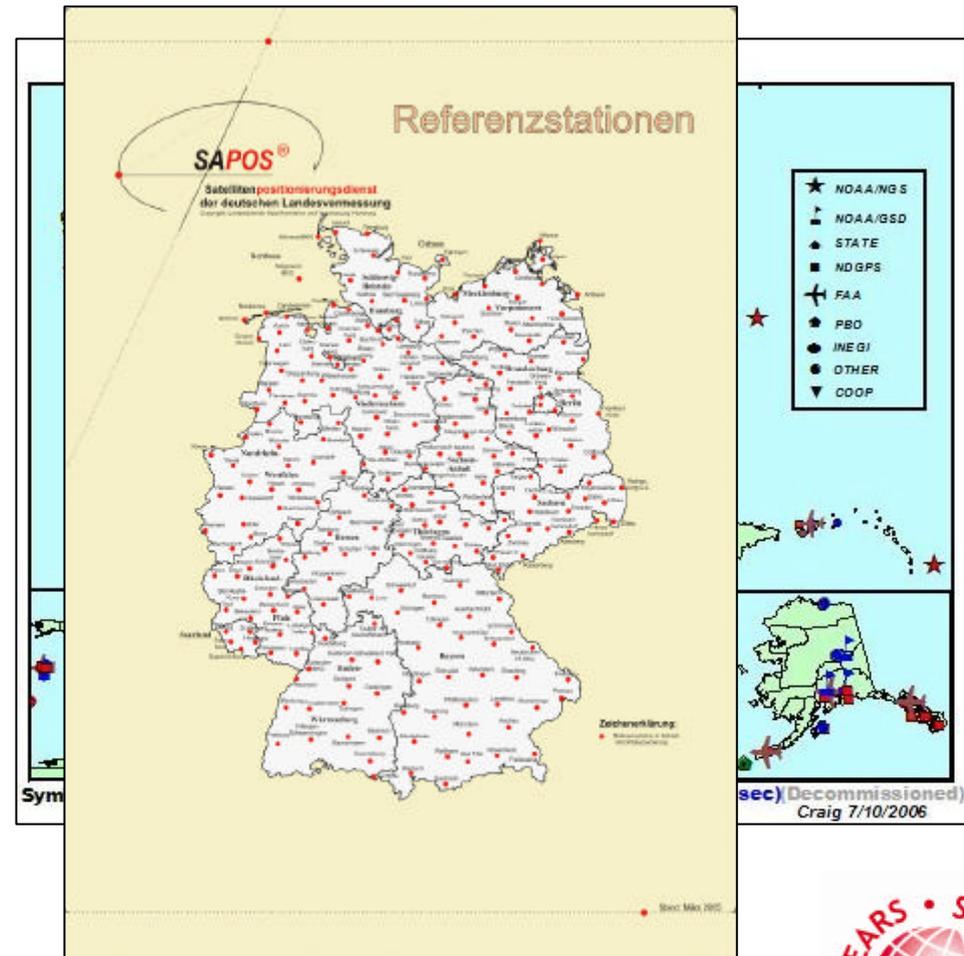


Trends in CORS ...

- From post-processing to Real-Time...
- Variety of RTK implementations...*single-base to network-based - hence sparser networks*
- RTK is synonymous with (exp.\$\$) dual-frequency Rxs
- Many networks...*ad hoc, industry-specific, etc.*
- Free data streams...*plus commercial ops...confusing 'data marketplace'*
- **Increased interest in the “business aspects” of CORS operations and GNSS-RTK services...e.g. *how to maintain & upgrade network?***

Govt CORS services: are the Business Models sustainable?

- 24/7 operations?
- Marketing of services?
- Realistic customer charges?
- Upgrade/maintenance strategies?
- Relations with private sector?



Towards sustainable 'Business Models'

- Should government land/survey agencies be RTK-SPs? Or sell data to companies?
- What Business Model would ensure GNSS-RTK services were 'profitable'?
- How can QC be incorporated within GNSS-RTK services?
- How can monopolistic practices be avoided?
- How can different SPs differentiate themselves?
- How to incorporate free RT data streams (*e.g. from IGS*)?
- What GNSS-RTK services would maximise the number of users?

GNSS-RTK Business Models

The physical CORS network infrastructure...
cooperative? partnerships? management?

Customer charges...*lessons from mobile telephony, service/hospitality industry?*

Adding value to GNSS-RTK...*new paradigms*

GNSS 'broker'...*broadening the offerings*



CORS Model 1: Govt network adequate

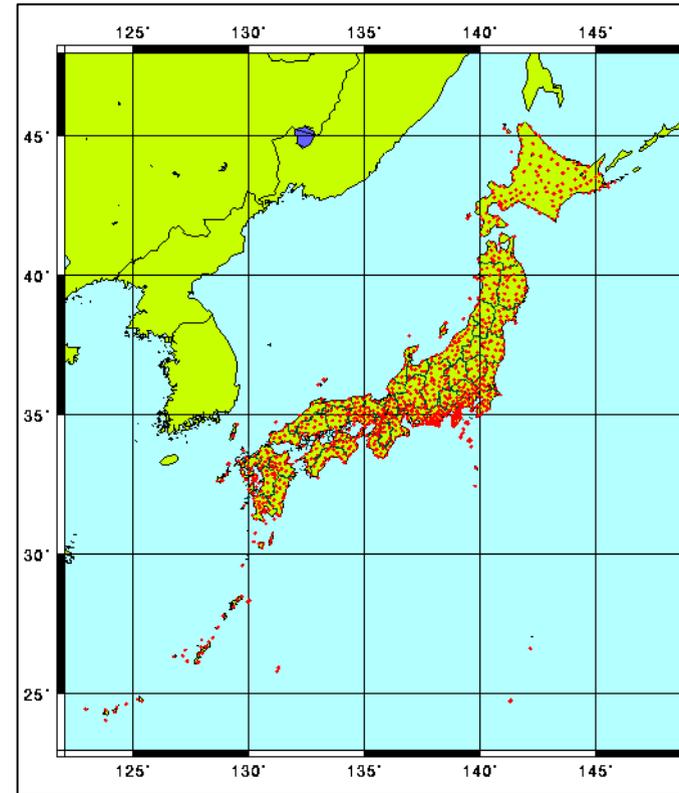
GSI's "GEONET" Rx's at 20-30km
spacing

Justified on 'geodetic basis', *hence
ongoing maintenance & QC assured*

GSI does not run a "business"

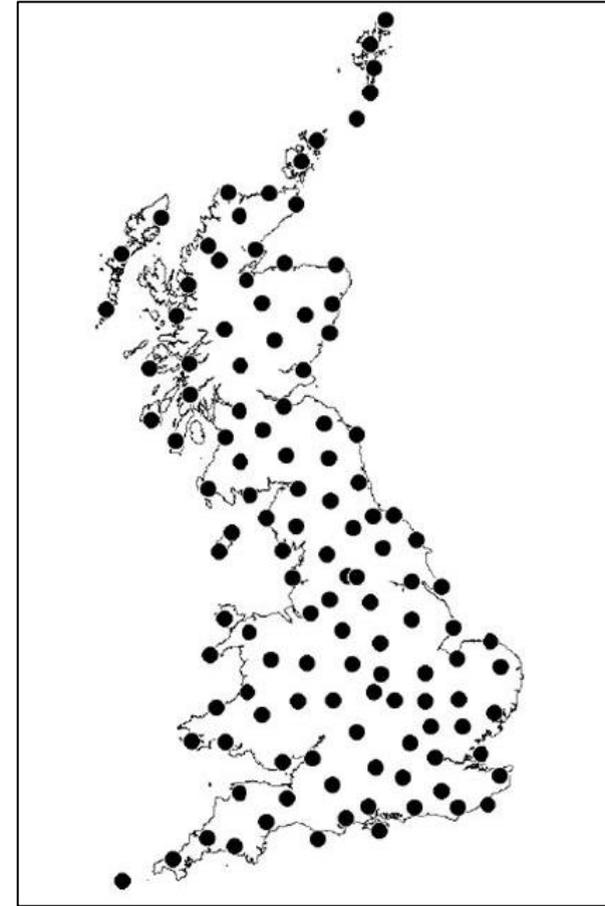
GSI licenses data streams to private
sector, *not just one company...*

*Competition to between different VA
services &/or Business Models*



CORS Model 2: VAR augments network

- Ordnance Survey (OS) establish 90 reference station backbone “OS Net”
- OS have provided Leica Geosystems with raw data feed from OS Net
- Add RT-IGS data & more than **extra** 40 stns installed by Leica
- Will add value by **increasing the capabilities** of full GNSS network, tracking all available signals from GPS, GLONASS & Galileo
- *Leica can implement other VA services &/or Business Models*



CORS Model 3: 100% private sector

- Full network, independent of traditional CORS (land survey agencies)
- Industry-based, e.g. precision agriculture, RT-surveying, monitoring, etc.
- Could use other infrastructure, e.g. utilities, telecom towers, etc.
- Initially unlikely to support cm-level GNSS-RTK services, *but*
- Could “in-fill” basic networks, or “hot-spot” deployment... *densification*
- May have questionable QC
- Partner Galileo’s Concessionaire?



Free Internet/'Starbucks' Model : *Customer focus elsewhere...*



- GPS agents/
manufacturers
invest in CORS
infrastructure
- Free (cheap?)
GNSS-RTK service
to users
- Concentrate on
sales of user
equipment

Mobile Telephony Model: *Maximise User Subscriptions*



- GPS agents/manufacturers offer cheap(subsidised?) or free user equipment
- Innovative subscription plans (like mobilephone) for GNSS-RTK service

Innovative GNSS-RTK Services: Client-Server Approach

What if, instead of broadcasting corrections or data, and placing onus of obtaining a final solution on users, advantage is taken of existing CORS infrastructure to compute coordinates, *in required reference system*?

Web-based services exist for post-processing data submitted by the user, using IGS products, *e.g. Auspos, Scout, Opus*.

New business model could extend this capability to **real-time**.

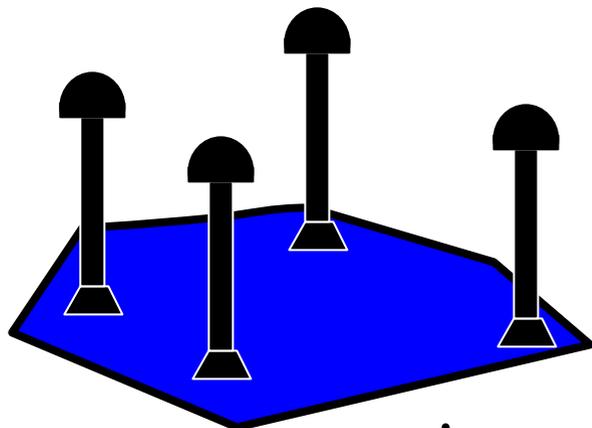
« Client-Server » approach **reverses** data flow, requiring user to transmit their data to network control centre server. *Optimal combination of stations for network computations & best possible position solution sent to user.*

Greater commercial “value” because results are quality assured.

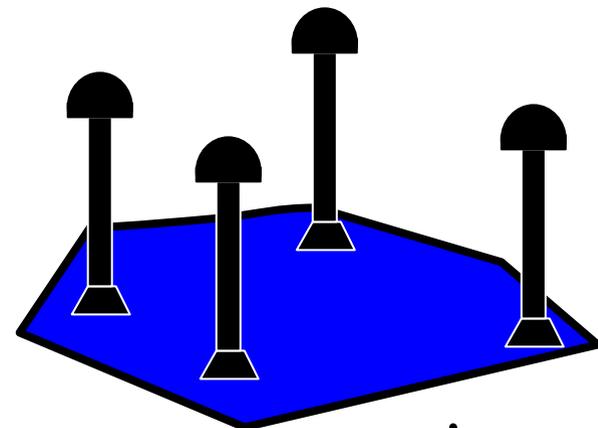
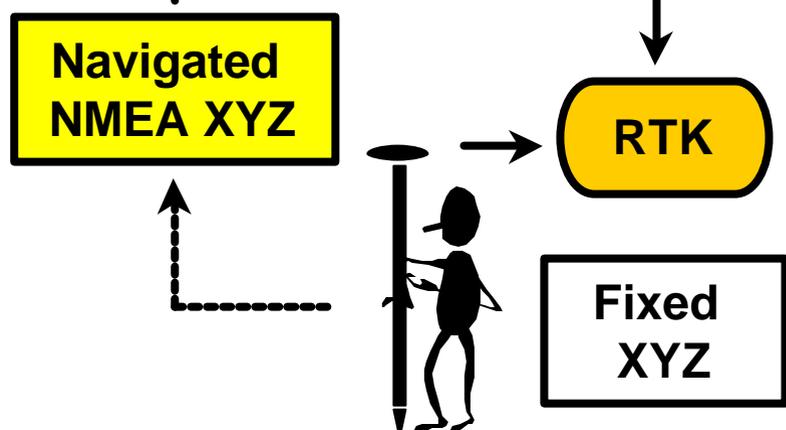
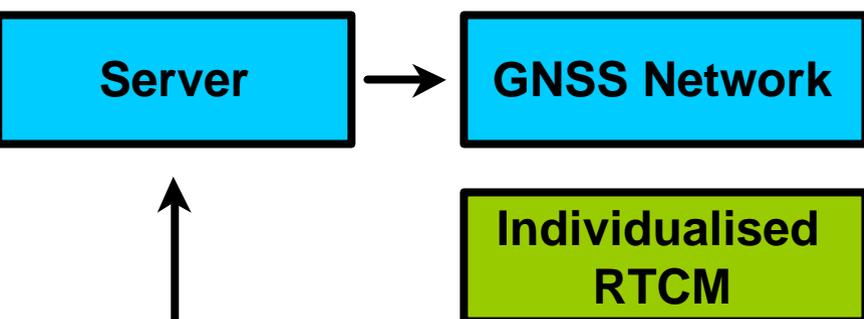
User does not need rover-installed GPS-RTK SW, *hence lower Rx costs?*

A-GPS type service for weak signal acquisition, *e.g. under trees*

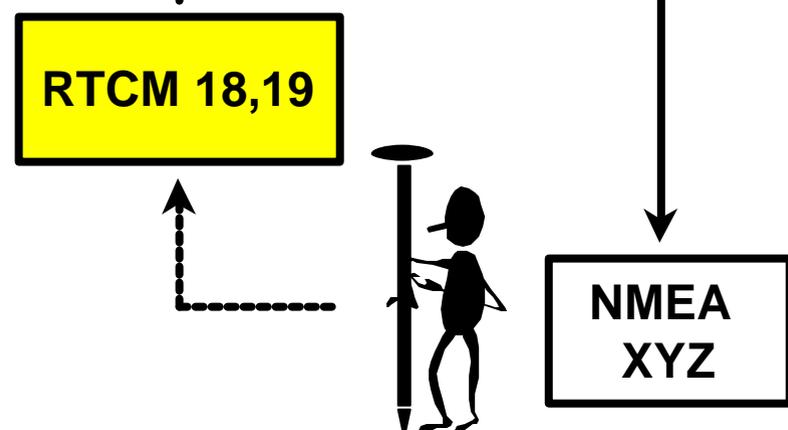
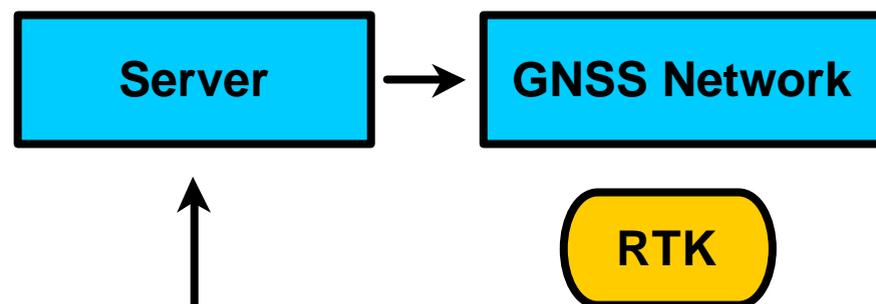


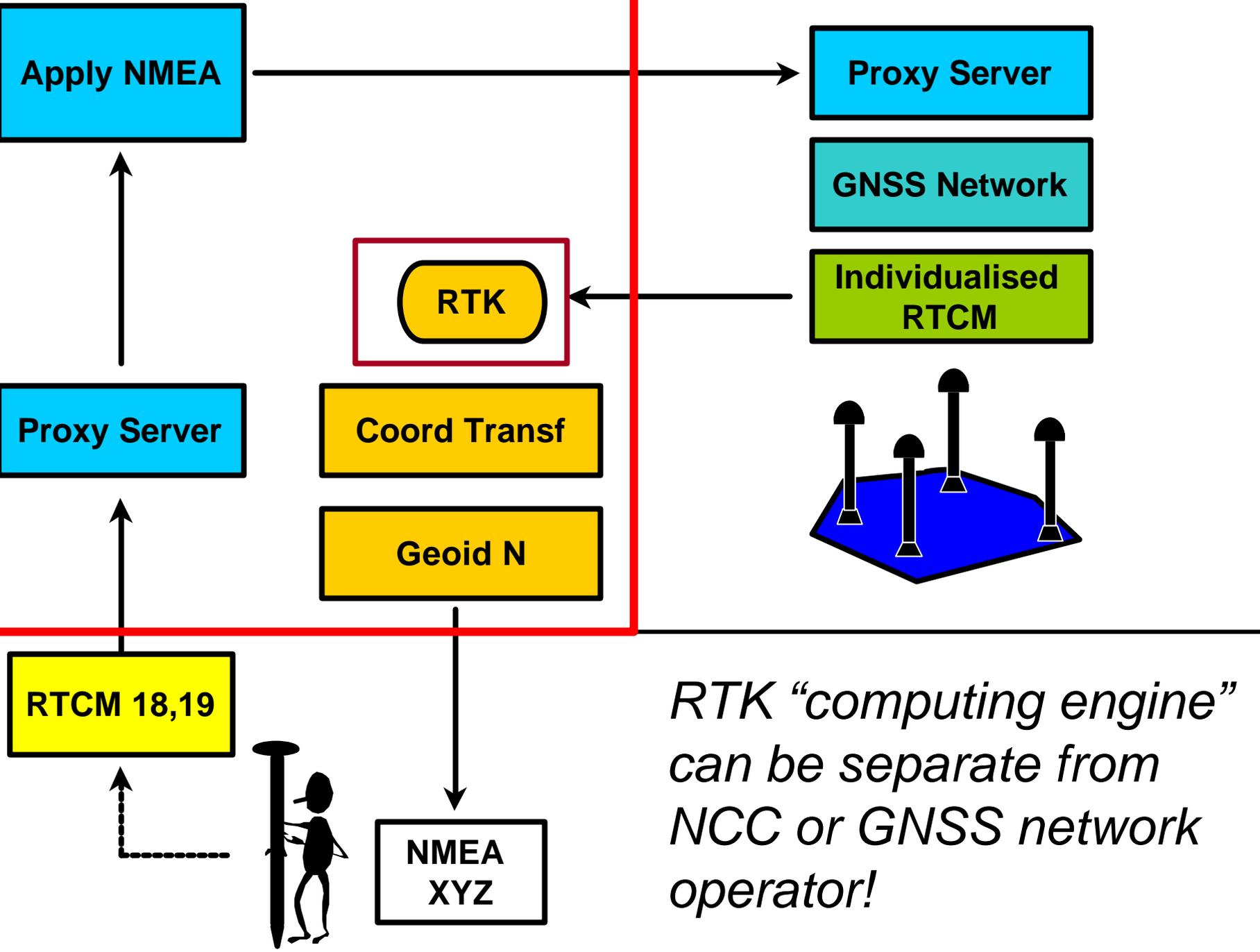


Std RTK



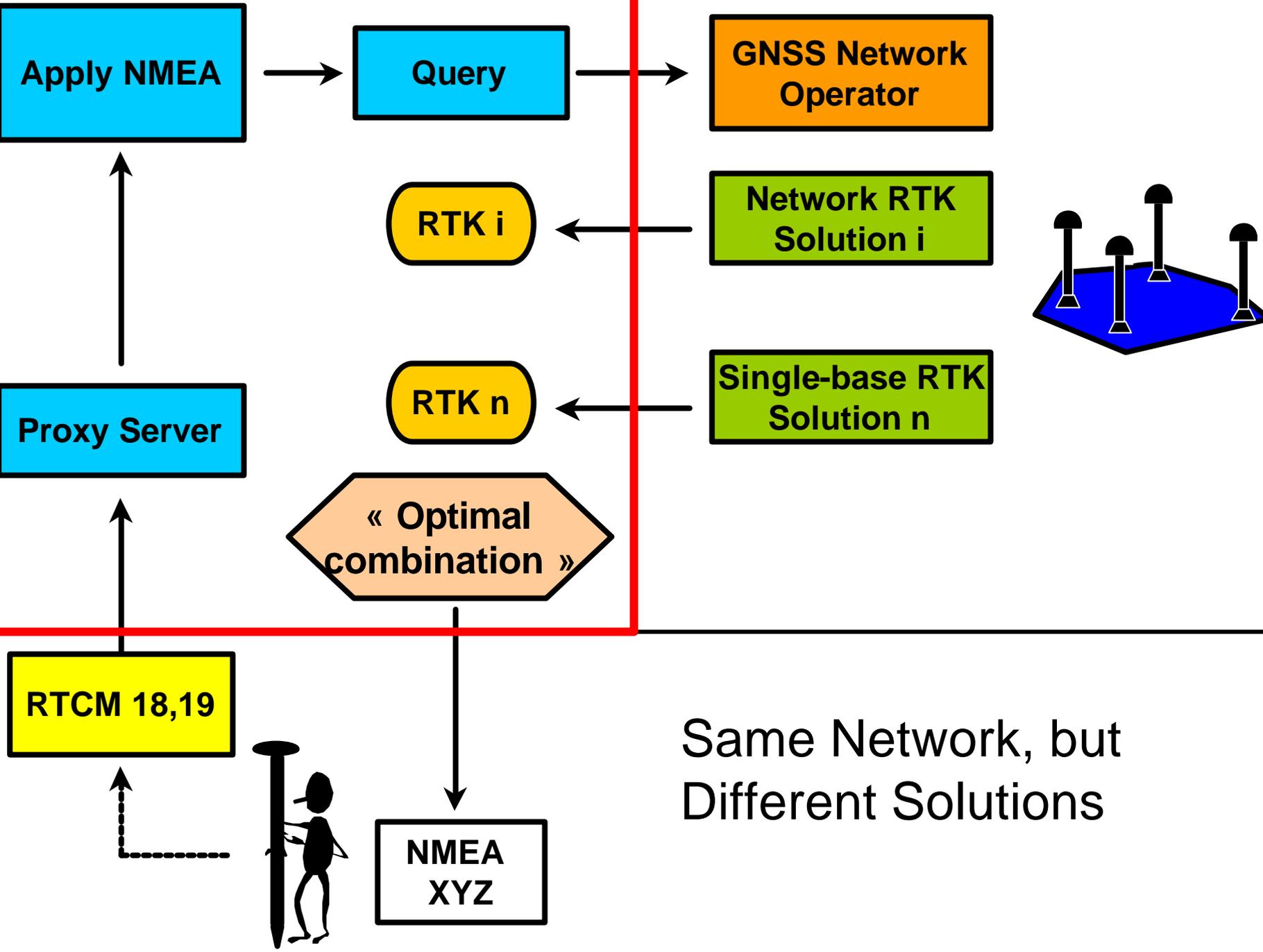
Reverse RTK

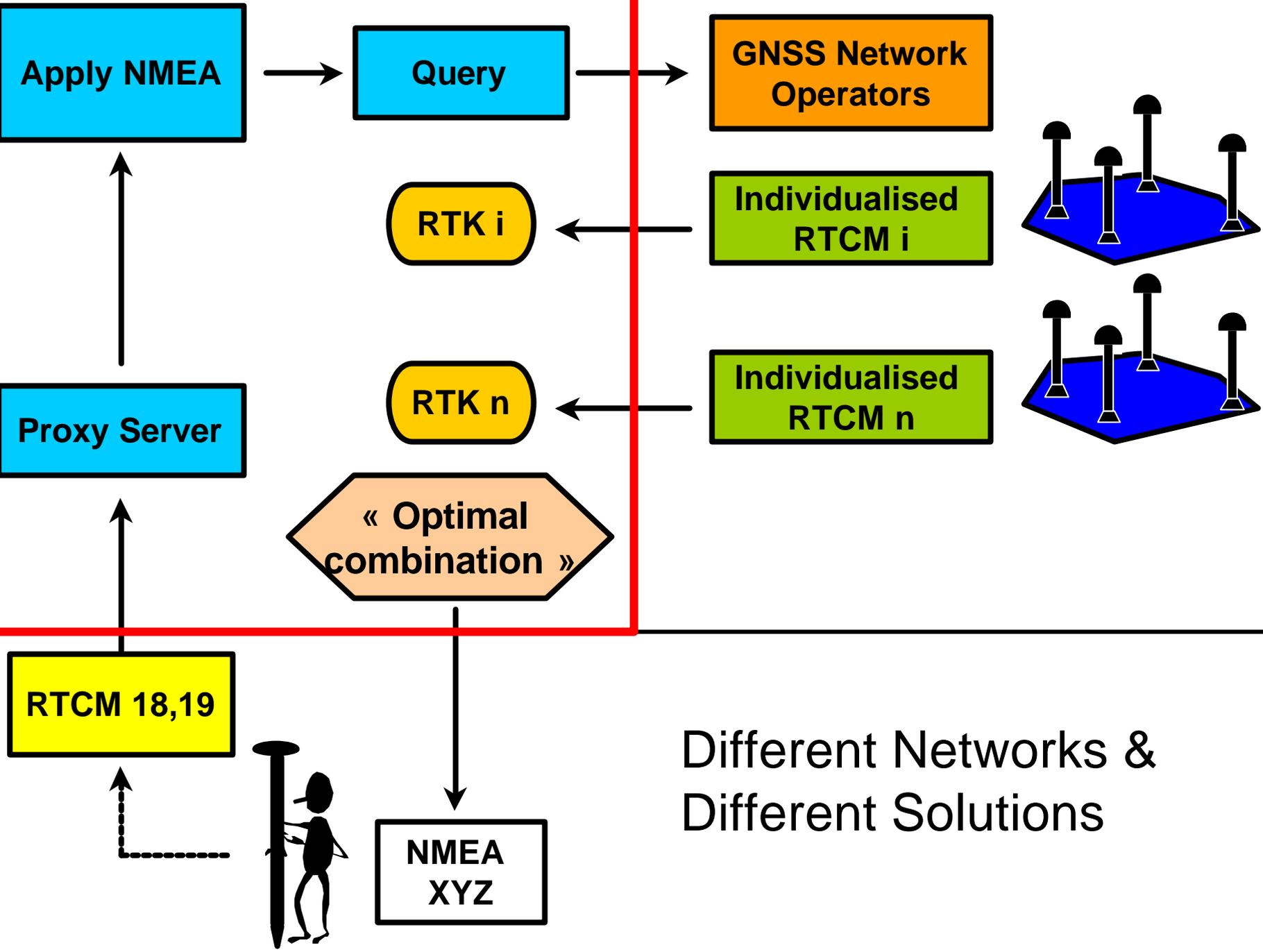




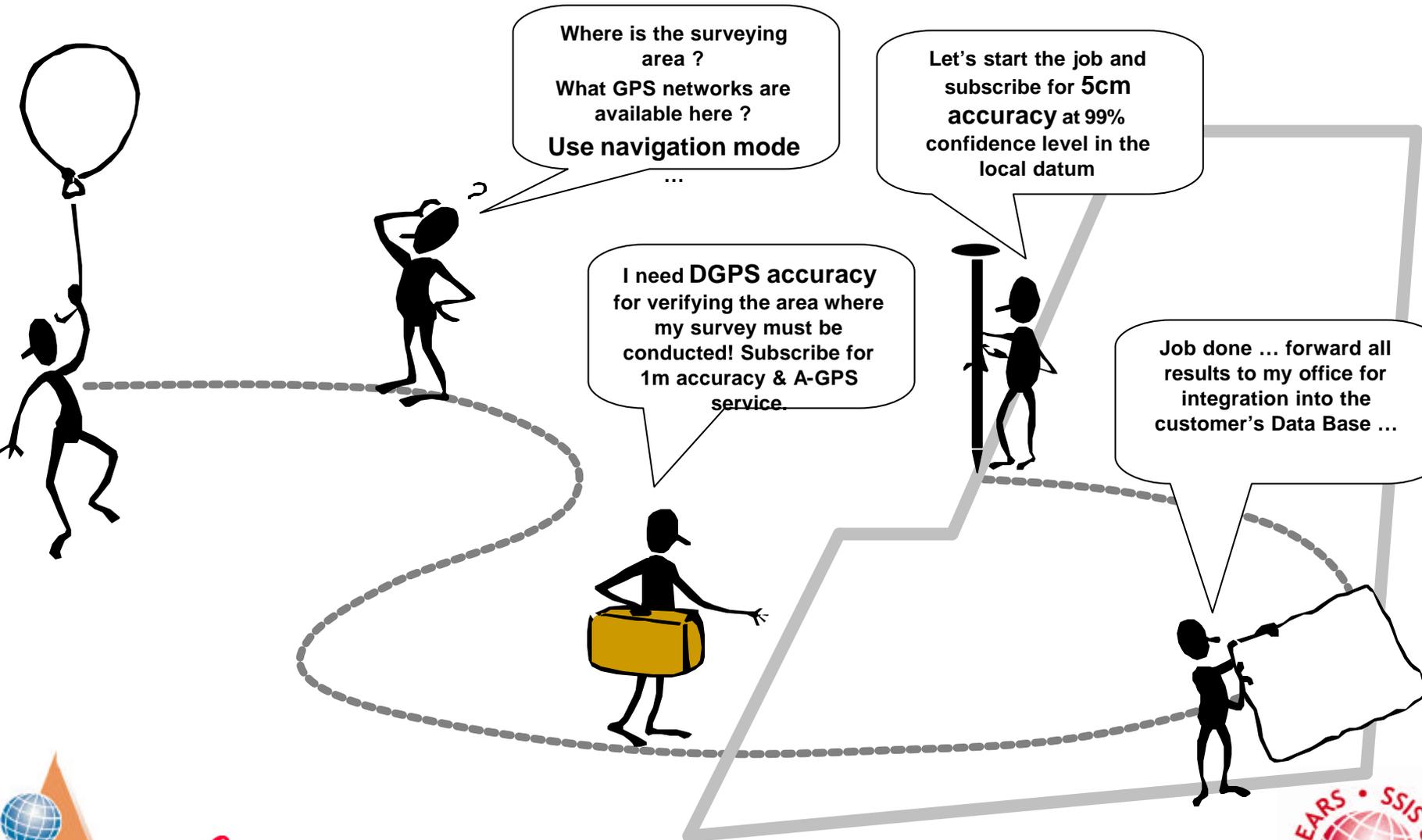
GNSS-RTK & the 'Middleman': Data/Service Broker

- 'Broker' operates as interface between user and different DGNSS services (varying accuracy, geographic spread...), as well as VA services (that enhance value of coordinates).
- 'Broker' need not be a GNSS service provider.
- 'Broker' gets the best « deal » for user.
- 'Broker' facilitates « global roaming ».
- 'Broker' manages coordinate generation via new services such as « reverse-RTK » (e.g. as in typical Fleet Management tracking / telematics services).
- 'Broker' provides quality assurance (if needed).
- **Broker provides valued service.**





Geopositioning Scenario 1



Geopositioning Scenario 2



Highway Authority, Maintenance
Section : please engage
immediately a monitoring action to
check bridge structure.

This time the
bridge is
really dancing
too much.

GPS monitoring
receivers are now
switched ON
bye ...

	CQ [m]	GDOP	S...	Last Change	X	Y	Z	Distance	Product Name	Site code	Ref-Site code	Send to	Processing	Initialisation
	0.037	3.3	6	18.02.2005 16:32:38	4263869.3874	722591.5227	4672986.3959	19.931 km	GeoMo5	Dac2	FLDK	GEOMOS	L1/L2	While Moving
	0.042	3.3	6	18.02.2005 16:32:34	4264776.1021	701896.3420	4675676.7184	29.360 km	GeoMo5	STGA	FLDK	GEOMOS	L1/L2	While Moving
	0.042	3.3	6	18.02.2005 16:32:39	4250605.5566	727184.8024	4684266.7727	37.667 km	GeoMo5	LIND	FLDK	GEOMOS	L1/L2	While Moving
	0.044	3.3	6	18.02.2005 16:32:34	4232700.5851	717748.1222	4701825.8330	62.548 km	GeoMo5	RAVF	FLDK	GEOMOS	L1/L2	While Moving

Geopositioning Scenario 3



Let's start the job and subscribe for GPS positioning at 50 cm accuracy at 95% confidence level in the local datum to survey this new building ..

Ooops ...GPS alone is not enough ... need more satellites. Will change my subscription for GNSS support !

Why so many security people in front of the building I am surveying ???

Sorry, I didn't know it was forbidden to work around here ... What ? You have fined me ?



Concluding Remarks (1)

- Permanent GNSS Networks are a geodetic legacy, *not initially intended to support real-time positioning applications.*
- With the development of GPS-RTK techniques, cm-level positioning has become a valuable surveying/mapping tool.
- Real-time services came to be offered by CORS network operators. However, *it is unlikely that many of these services are run on a sustainable business basis.*

Concluding Remarks (2)

- New business models are needed if network operators are to generate the revenue necessary for infrastructure maintenance and upgrade. *Partner with private sector.*
- One set of models are based on the Client-Server architecture, and reverse-RTK concept. *The client pays for a reliable service.*
- Variations of this basic model can be developed by studying service businesses. *E.g. using data/service brokers, subsidising HW, subsidising service, etc.*
- Service Broker is an innovative new model for supporting a range of VA services, *not only standard GNSS-RTK.*

Concluding Remarks (3)

- Triple-frequency GNSS-RTK will require less CORS infrastructure.
- New CORS SPs will enter the « RTK market », e.g. *telcos, utility companies*.
- More competition between CORS SPs.
- SPs may want to differentiate themselves via new VA services.
- In future **Accurate GNSS Positioning** will be handled like any other ICT service, e.g. *'RTK roaming', LBS, web services*.
- Increased use of brokers who 'aggregate' RTK services.