Second technology presentation

SATELLITE COMMUNICATION

Template reference : 100181670S-EN

SATELLITE COMMUNICATION

- Fixed vs mobile
- Parameters
- Network topologies
- Available systems
- Regulatory
- Discussion

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Fixed vs Mobile

- Solution application driven
- Bandwidth requirement
- Cost
- Terminal complexity
- Latency
- Mobility

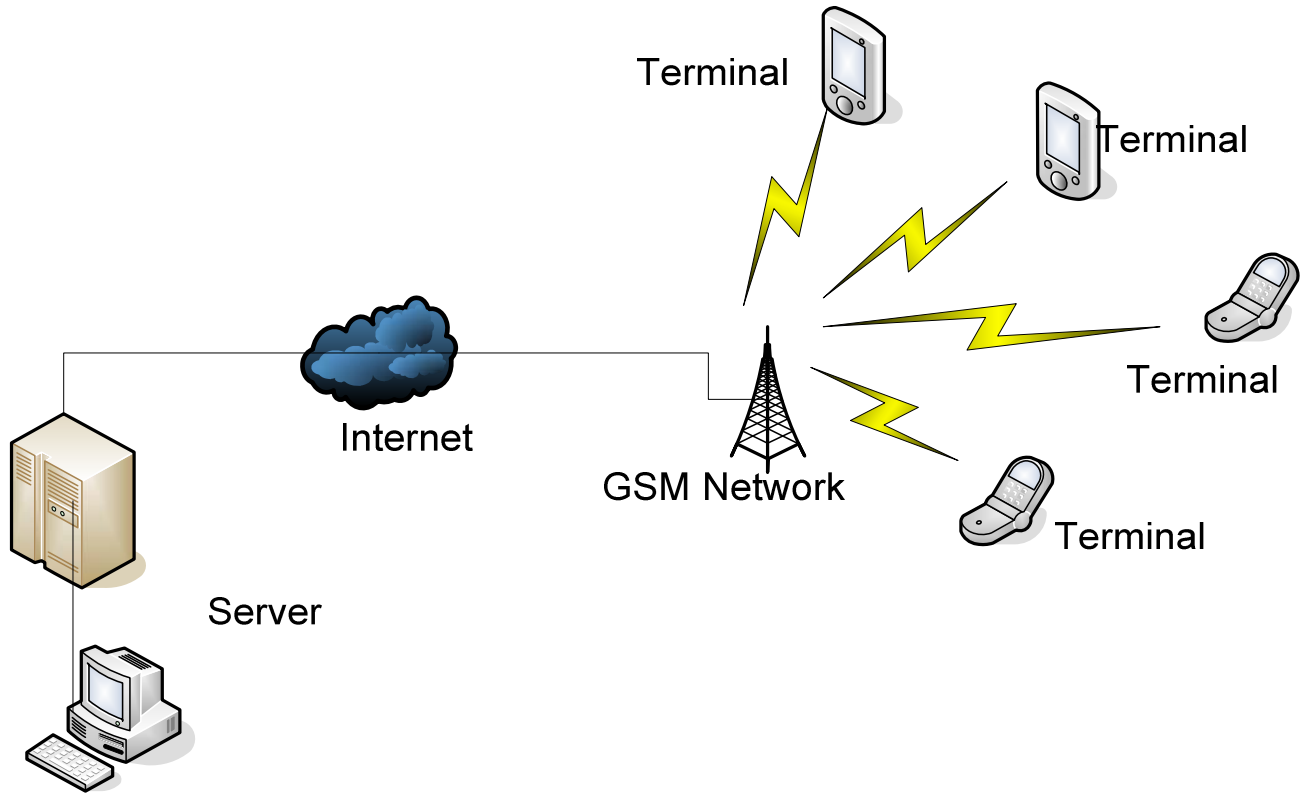
Common frequency bands

Frequency band	Receive frequency		Typical antenna at user premises	Common applications
	Minimum Frequency	Maximum Frequency		
VHF	30MHz	300MHz	Whip antenna or YAGI antenna	Television and radio, radio ham
UHF	300MHz	800MHz	Whip antenna or YAGI antenna	Television and radio, radio ham
L band	1GHz	1.8GHz	Patch antenna	GSM, GPS and Satellite radio eg. Worldspace, Satellite mobile eg. Thuraya
S band	2GHz	2.4GHz	Patch antenna	Satellite radio eg. XM Radio, Sirius
C band	3.6GHz	4.2GHz	3.7m dish	International links, telephony, largely dispersed VSAT networks, SNG
X band	7.5 GHz	10GHz	2.4m dish	Military communications
Ku band	10.75GHz	12.75GHz	VSAT, SNG, DVB-RCS: 1.8m dish DTH: 90cm dish	Regional VSAT networks, DTH broadcast, DVB-RCS, SNG
Ka band	17.7GHz	21.2GHz	30cm dish	Broadband to the home, office.

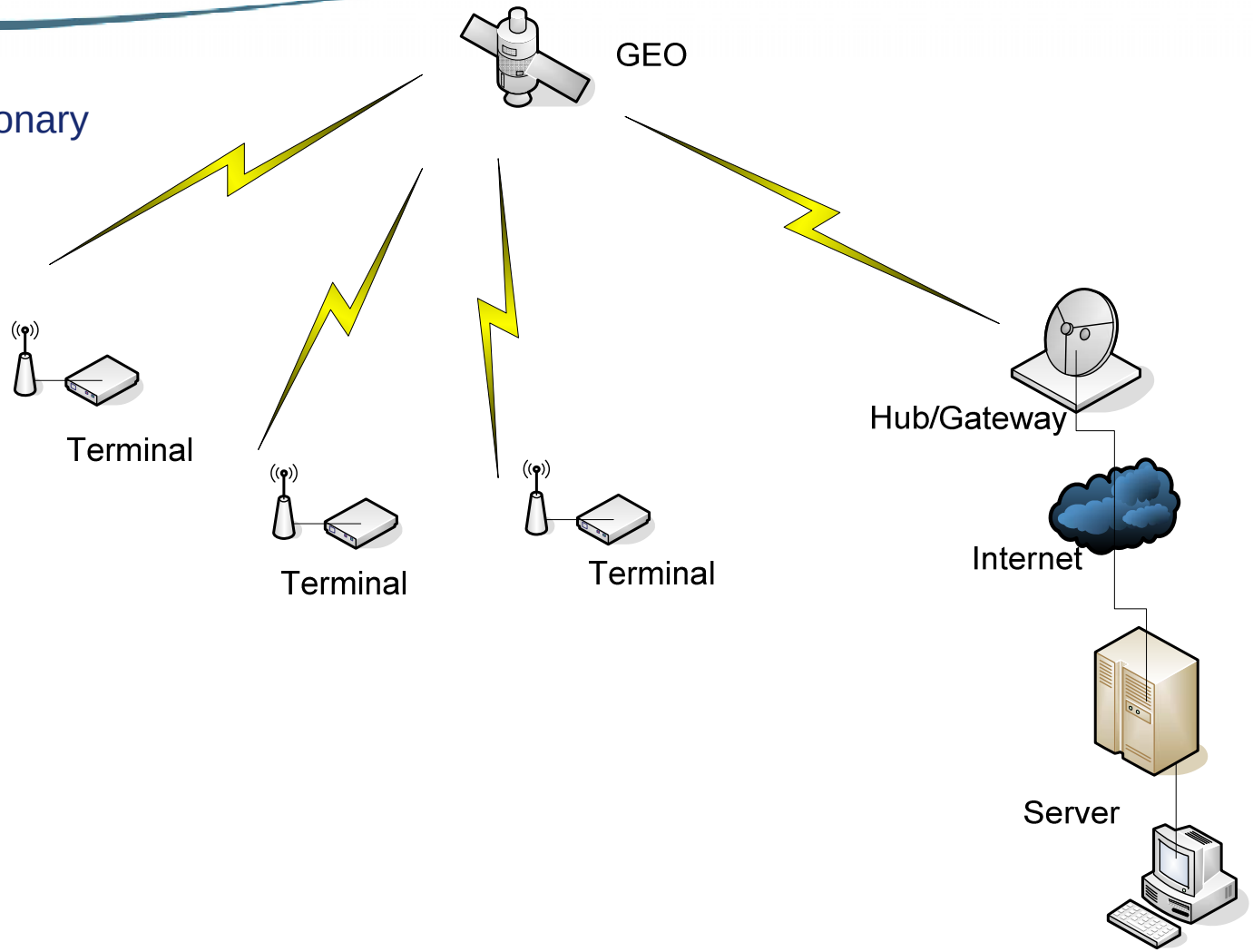
Parameters

- Coverage
- Cost: Infrastructure and bandwidth
- DATA structure size
- Mobility vs Transportability
- Latency: Time critical applications
- Complexity: Size of network
- Regulatory
- Interface: GPS, Device telemetry
- Interoperability: Switchover to available network

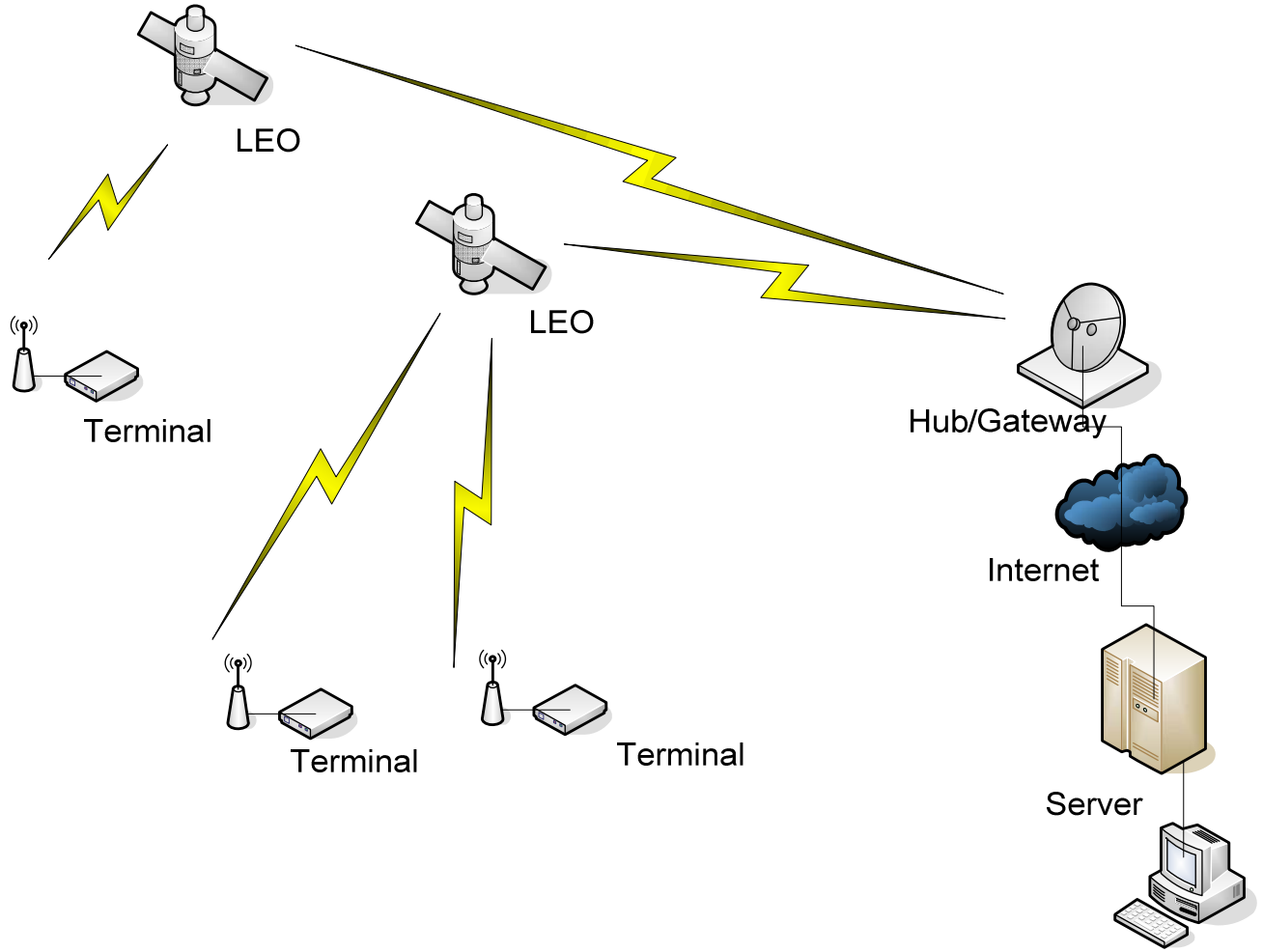
GSM


Terminal
Terminal
Terminal
Terminal
Internet
GSM Network
Server

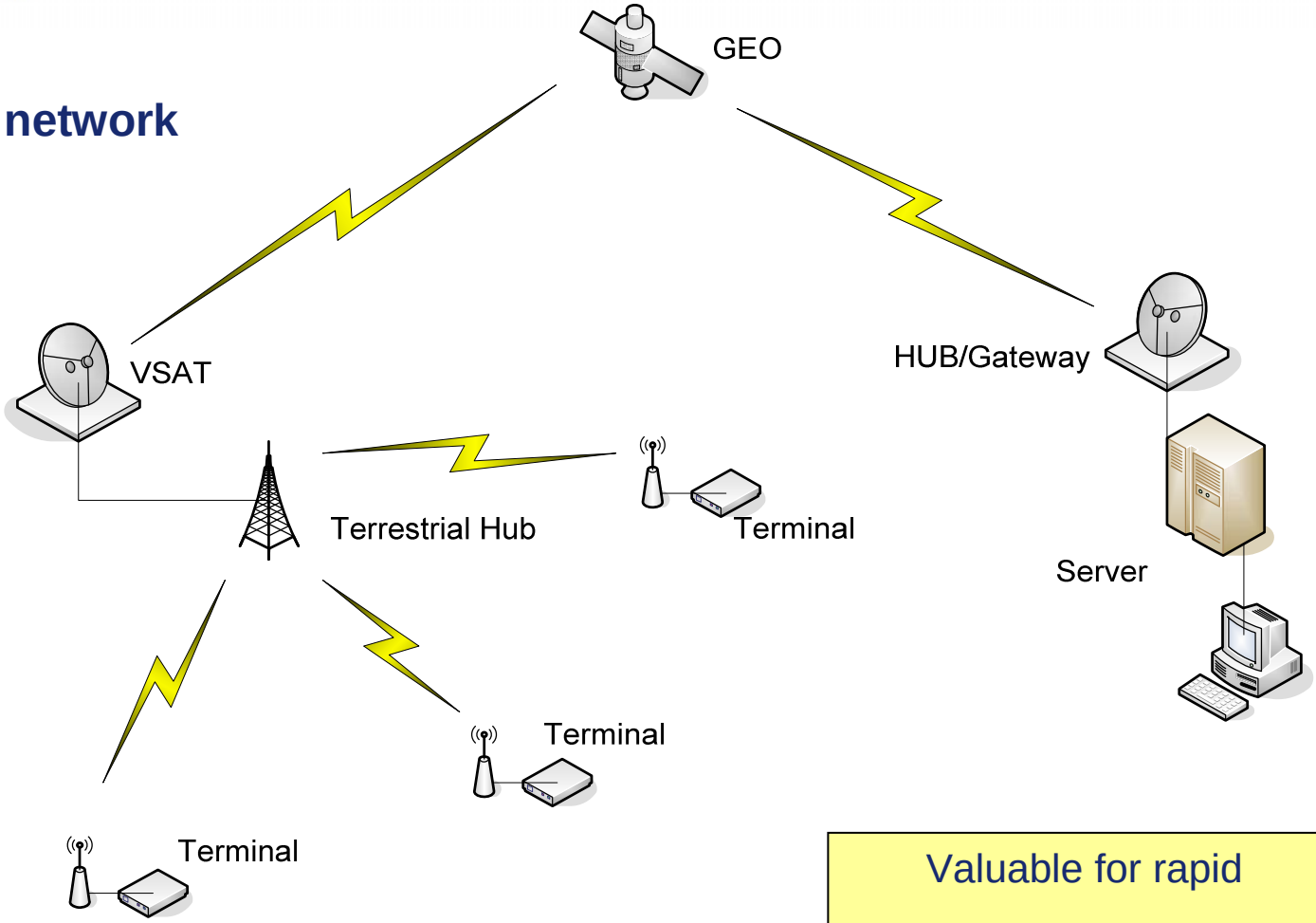
Geostationary satellite



LEO Constellation

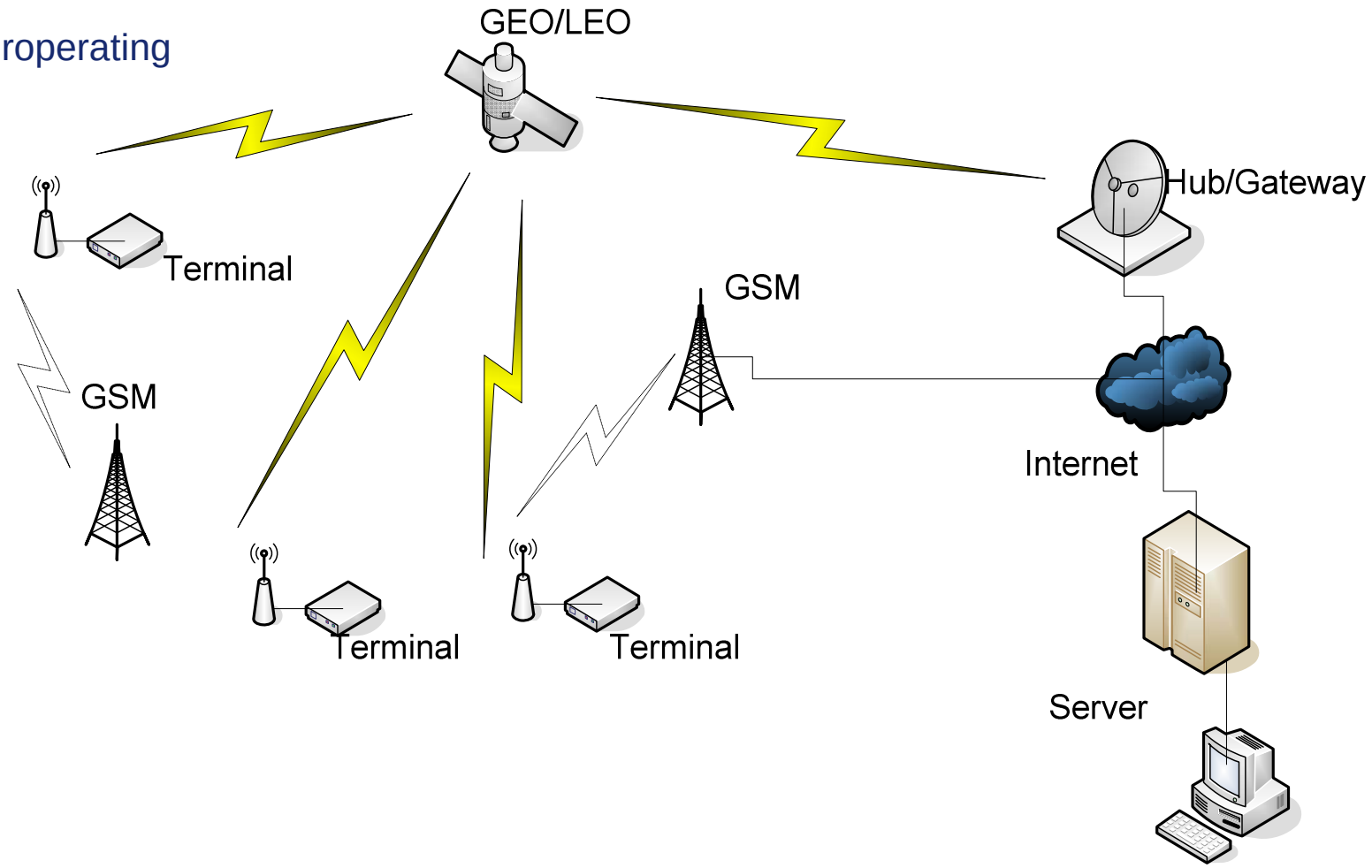


Hybrid network



Valuable for rapid deployment during disaster

Interoperating



Systems available

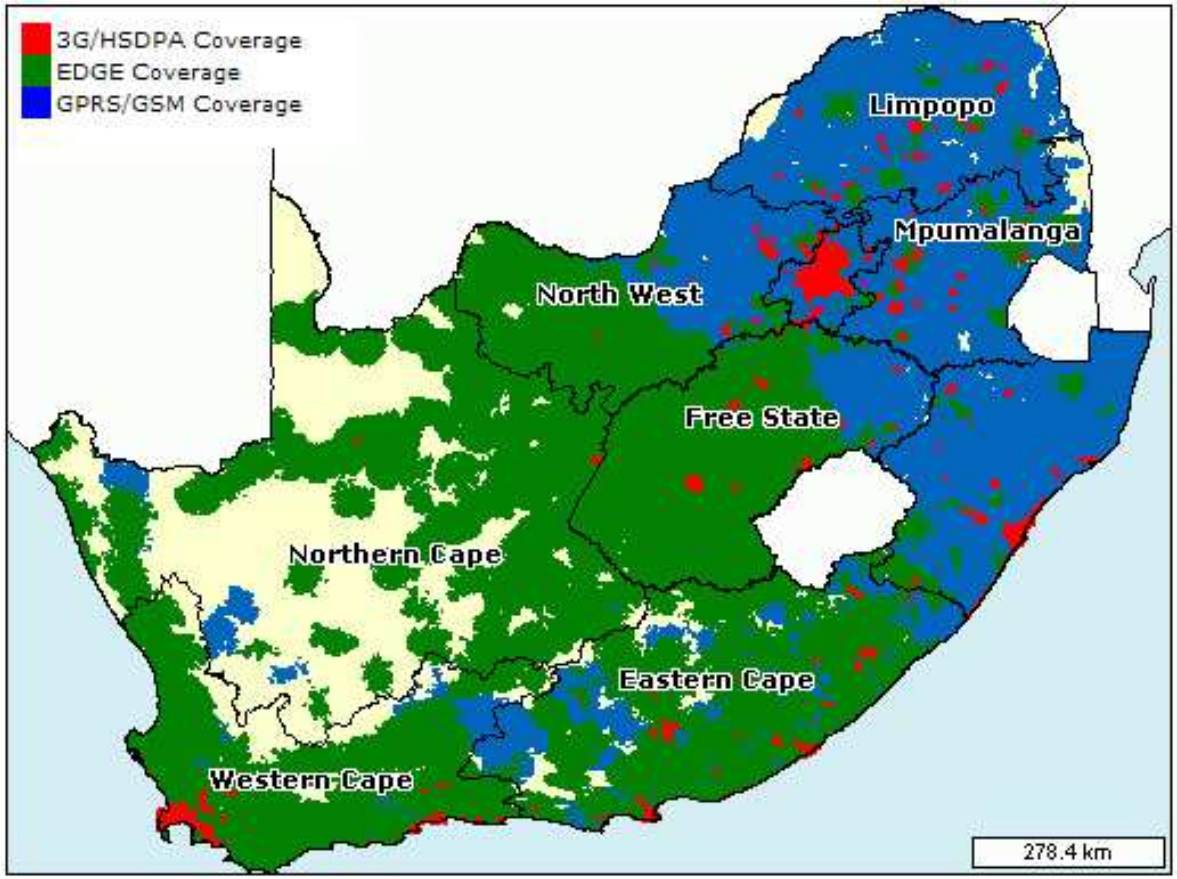
- **GSM (GPRS,EDGE,3G,HSDPA)**
- **Inmarsat:**
  - BGAN
  - Globalwave (MT2000)
  - Isat
- **ORBCOMM**
- **IRIDIUM**
- **THURAYA**
- **GLOBALSTAR**
- **Euteltracs system**
- **Spacechecker**
- **VSAT**
- **Other terrestrial**

- **Good data connections available**
- **Coverage and availability**
- **Mobility**

No guarantee of service

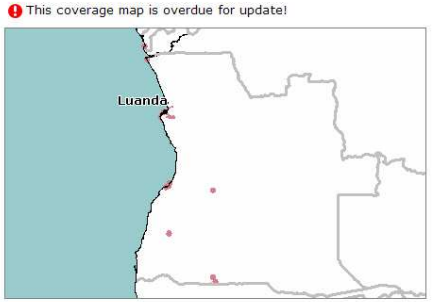
Local coverage ‘holes’

GSM: Coverage 1/3

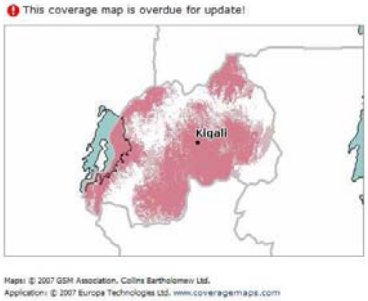


GSM: Coverage 2/3

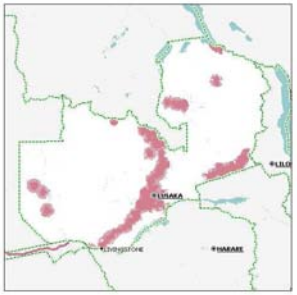
Angola



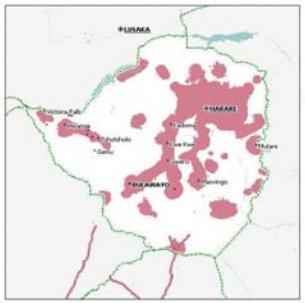
Rwanda



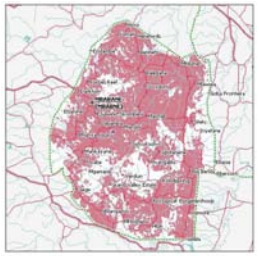
Zambia



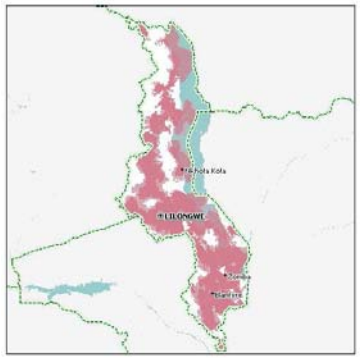
Zimbabwe



Swaziland

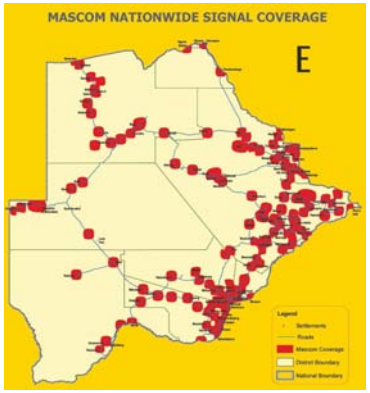


Malawi

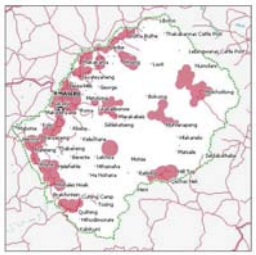


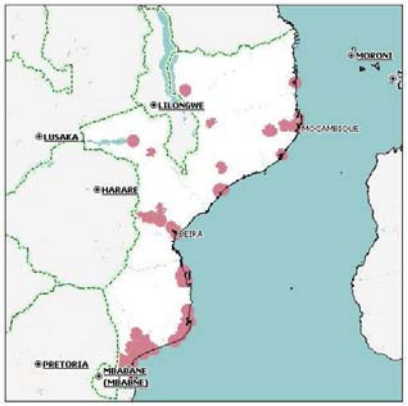
GSM: Coverage 3/3

Botswana



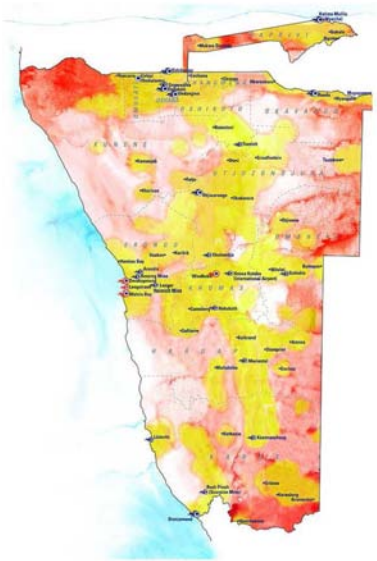
Lesotho





Mozambique

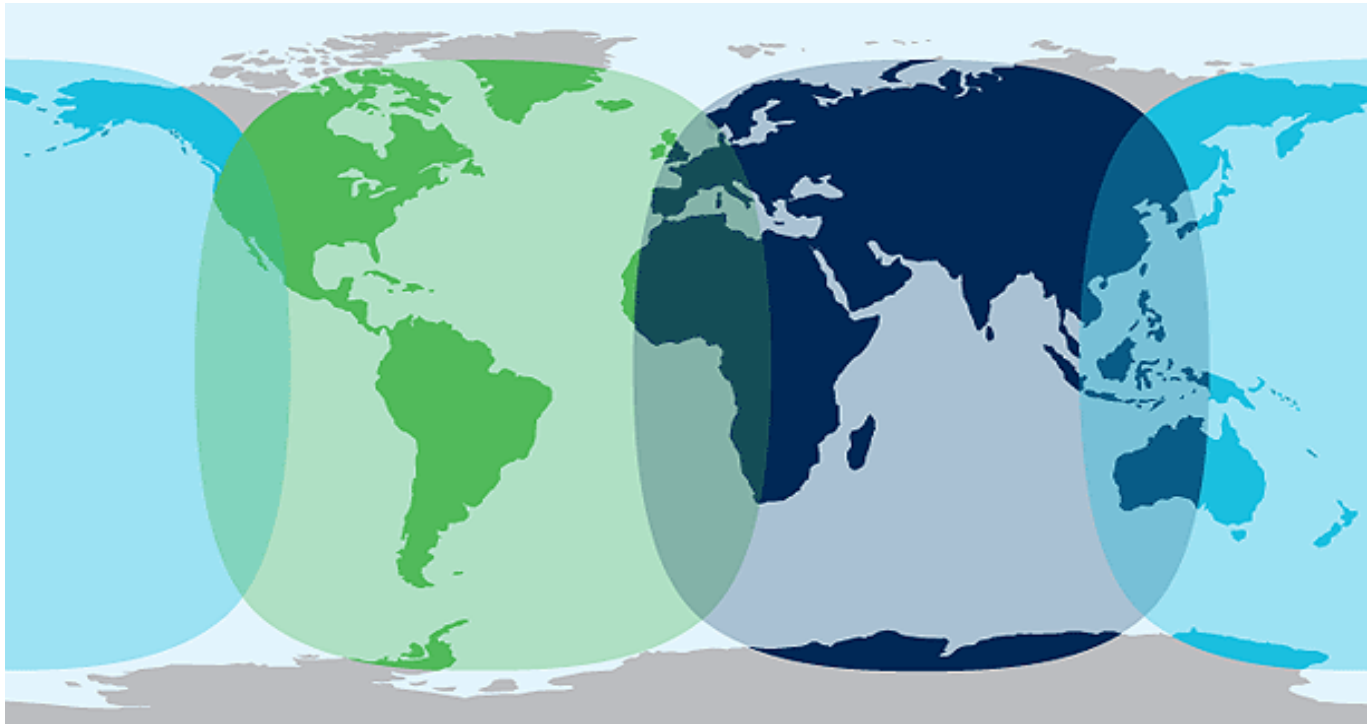
Namibia



Madagascar

BGAN 1/2

- **Transportable**
- **Standard IP:** Up to 448/464kbps (send and receive)
- **Streaming IP:** 32, 64 or 128kbps (send and receive)
- **ISDN:** via USB
- **Voice:** Via RJ-11 or Bluetooth handset, 3.1 khz audio
- **Data Interfaces:** USB, Bluetooth, Ethernet



Key

I-4 satellite F1 — I-4 satellite F2 — I-4 satellite F3 (launch date to be finalised)

The map depicts Inmarsat's expectations of coverage, but does not represent a guarantee of service. The availability of service at the edge of coverage fluctuates depending on various conditions.

Isat 1/2

- **Antenna:Single satellite and GSM dual mode antenna**
- **Talk time:Up to 2 hours 40 minutes (satellite and GSM)**
- **Standby time:Up tp 42 hours (satellite and GSM)**
- **Data / fax:2400bps (satellite) and 9600bps (GSM)**

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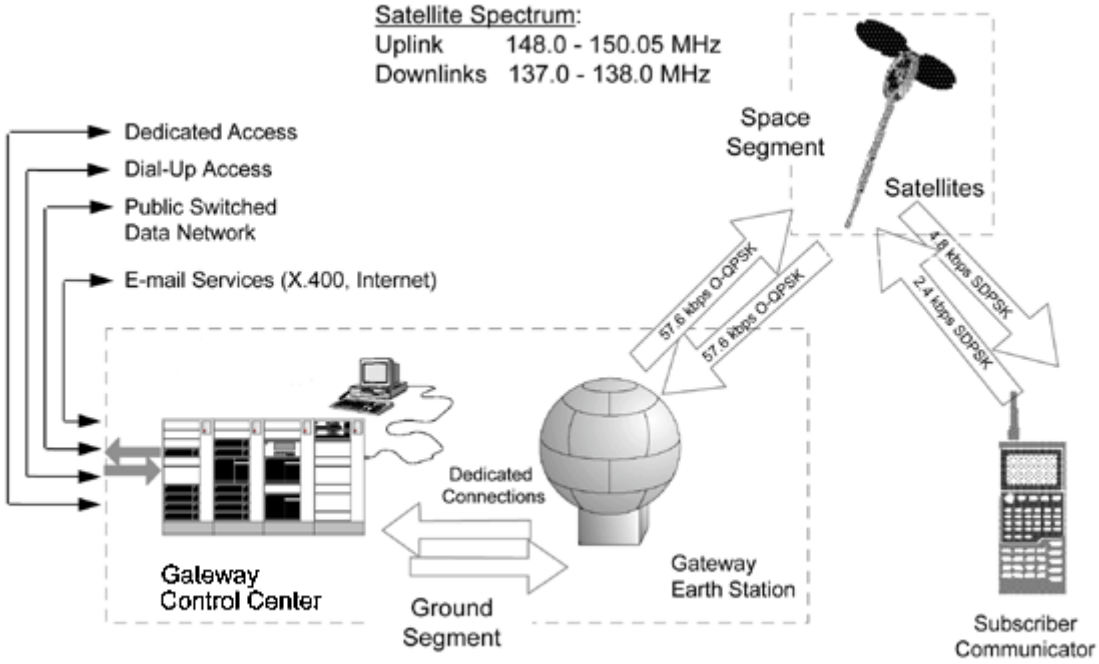
The map depicts Inmarsat's expectations of coverage, but does not represent a guarantee of service. The availability of service fluctuates depending on various conditions.

- **L-band system**
- **Widebeam patch antenna**
- **Inmarsat satellites**
- **Satellite coverage across Africa**
- **30m Hub antenna in Australia**
- **Latency < 45sec**
- **Link**
  - Forward (to terminal): Up to 38bytes at 1200bps
  - Return (from terminal): 11bytes at 350bps
- **Terminal battery life:**
  - Li: Up to 3.5years operation

Orbcomm 1/3

- **GMPCS System**
- **Message size**
  - Up to 64kB
  - Uplink 2400bps
  - Downlink 4800bps
- **Latency currently <= 30min**
- **Intended gateway**
- **New terminals interoperate**
- **VHF system**



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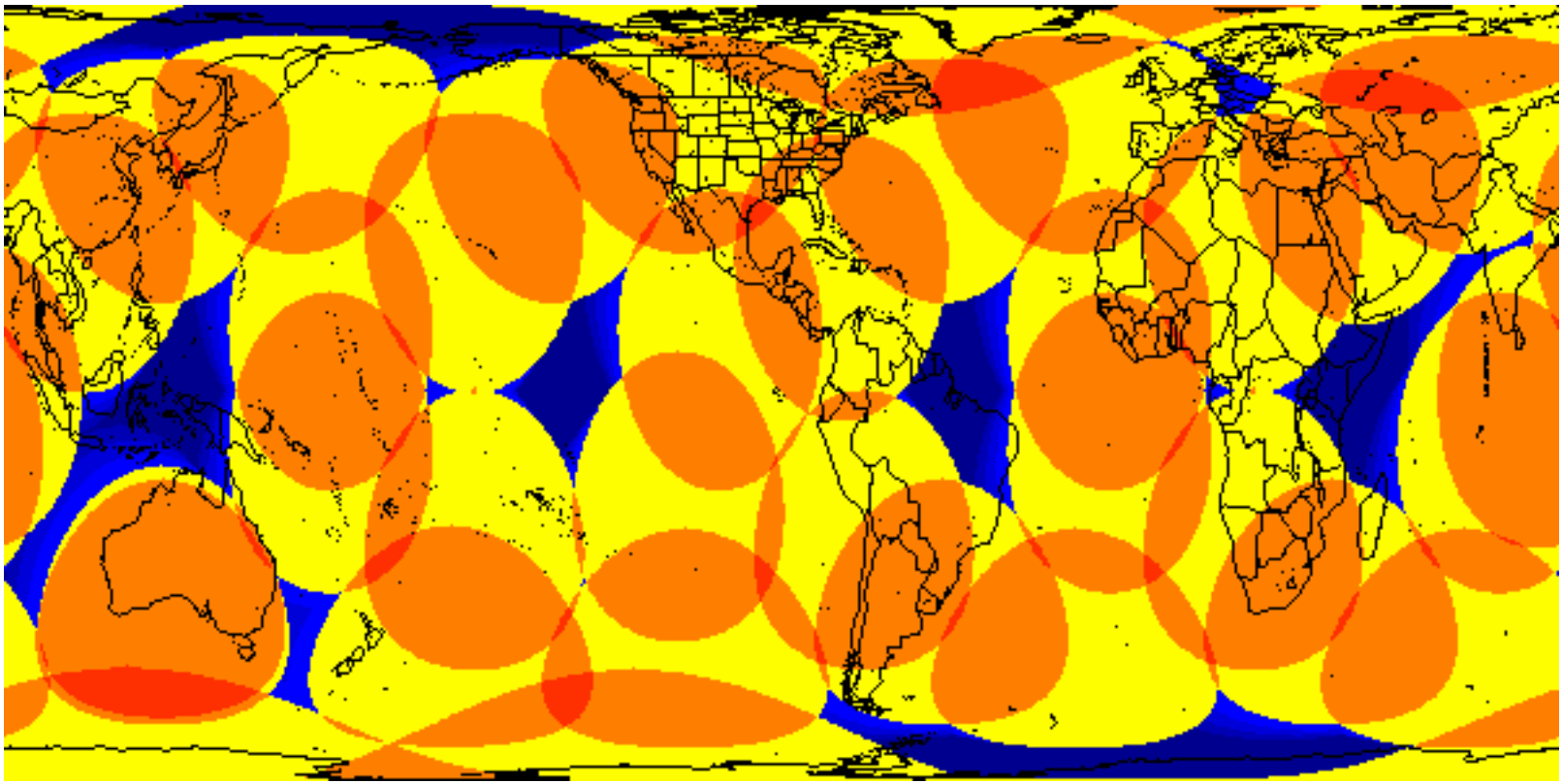
Coverage

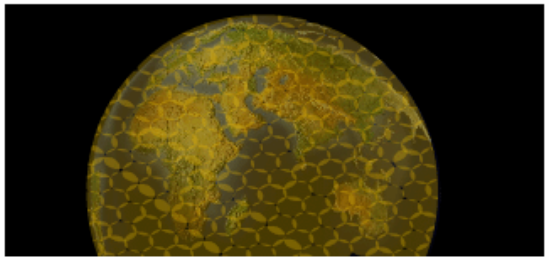


Orbcomm 3/3

Iridium 1/2

- Small form factor
- RS 232 Serial interface
- Global coverage
- 205 bytes per message
- Up to 2.4Kbps
- SMA Antenna Connector to connect to small omni directional L-band antennas
- Simple AT Command interface

Iridium Satellite Network Coverage



The cross-link and spot beam technology give the Iridium Satellite Network...

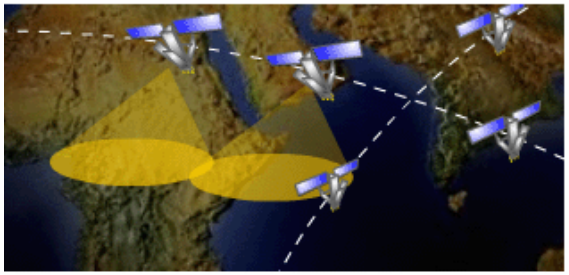
Total Coverage of the Earth

Spot Beams - 48 per satellite

(approx. 250 miles / 400 kilometers in diameter per beam)

Iridium provides a total global communications solution!

Iridium Satellite Cross-Links



Advantages

* Less reliance on wireline networks
* Continuous talk time
* Fewer outages
* Higher reliability
* Don't need to be in the same footprint as the gateway

Iridium provides a total global communications solution!

Iridium Satellite Advantages and Benefits

Advantages

* Satellite Cross-links
* Digital Network
* Signal Strength
* GSM Platform Based
* Global Paging

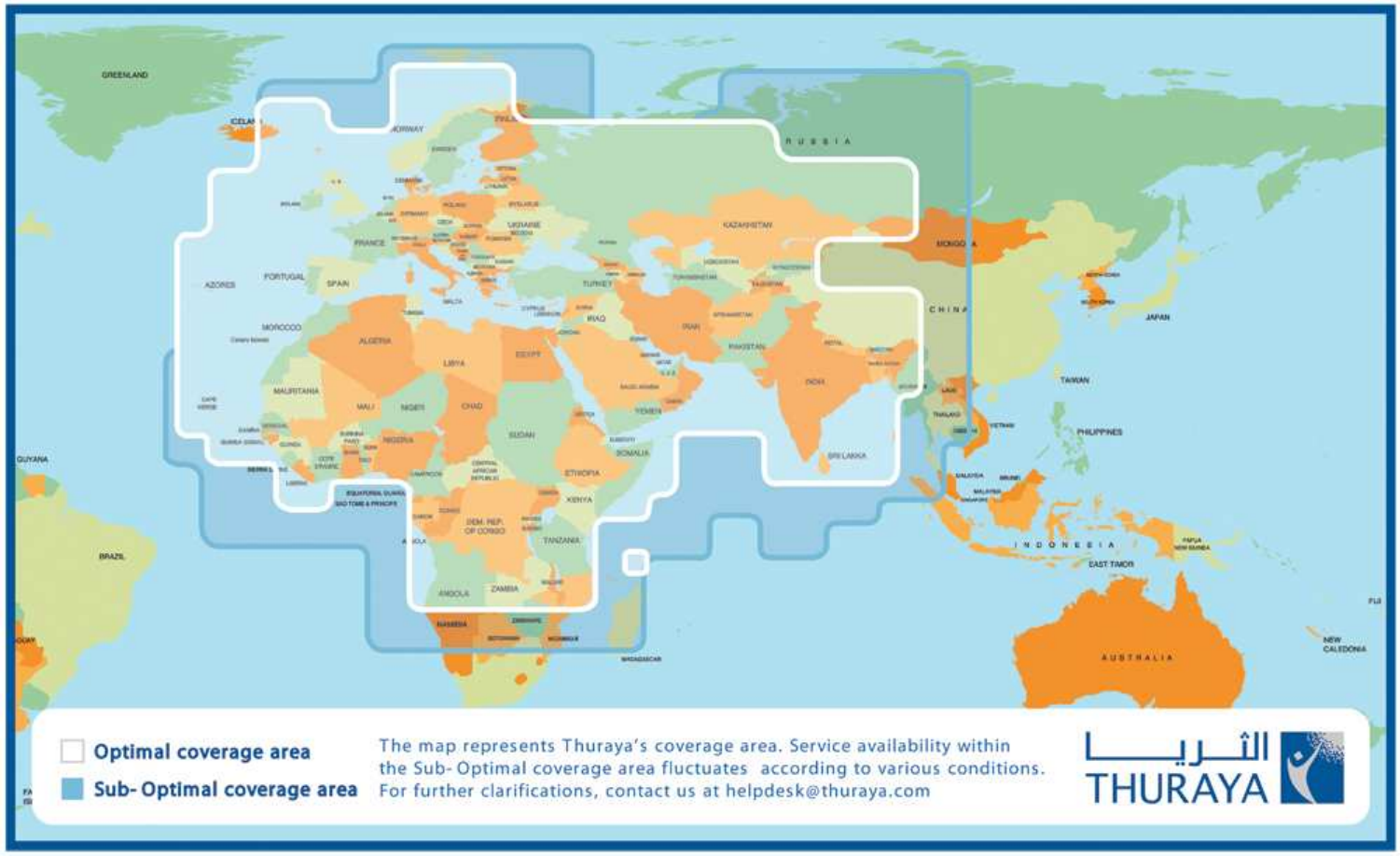
Benefits

* Global Coverage
* Consistent Quality
* Reliability
* Total communication system
* Robust features and functionality
* Always in touch

Iridium provides a total global communications solution!

ThurayaModule Specifications

- **System**
  Satellite, GSM Tri-Band (900/1800/1900)
- **Enhanced GPS Feature**
- **Camera**
  Integrated 1.3 megapixel
- **GmPRS capabilities**
  - Satellite mode
    Downstream: up to 60 Kbps
    Upstream: up to 15 Kbps
  - GSM mode:
    Downstream: up to 85.6 Kbps
    Upstream: up to 42.8 Kbps
- **Operating System**
  WinCE 4.2
  - Battery
    Satellite Mode
    Talk Time up to 2.4 hrs
    Standby time up to 40+ hrs
    GSM Mode
    Talk time up to 4.0 hrs
    Standby time up to 75 hrs

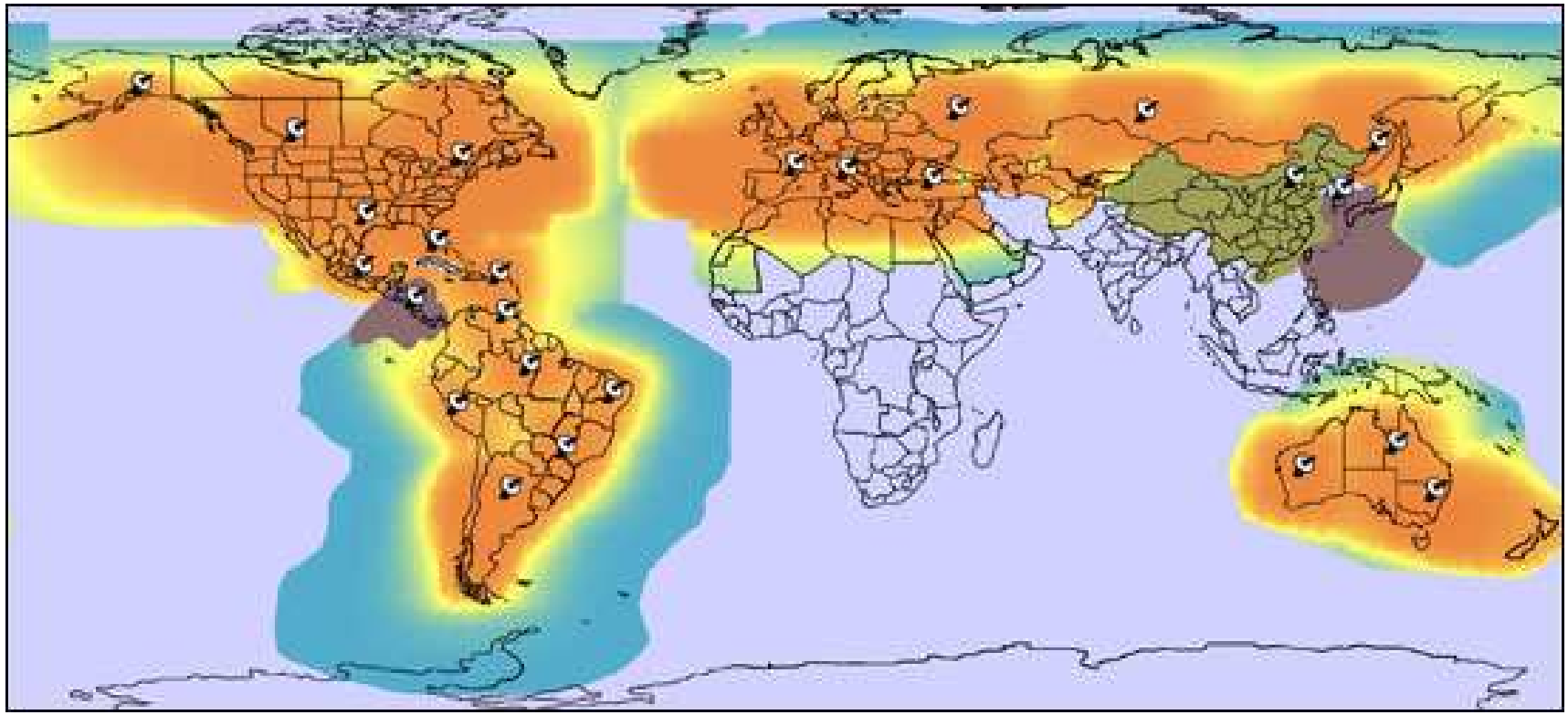

Optimal coverage area
Sub- Optimal coverage area
The map represents Thuraya's coverage area. Service availability within the Sub- Optimal coverage area fluctuates according to various conditions.
For further clarifications, contact us at helpdesk@thuraya.com
الثريا
THURAYA

Globalstar 1/2

- **Globalstar satellite phone and data kit**
  - speeds of up to 56 kbps over the Internet

Regulatory constraints limits deployment of Globalstar

CSIR THALES



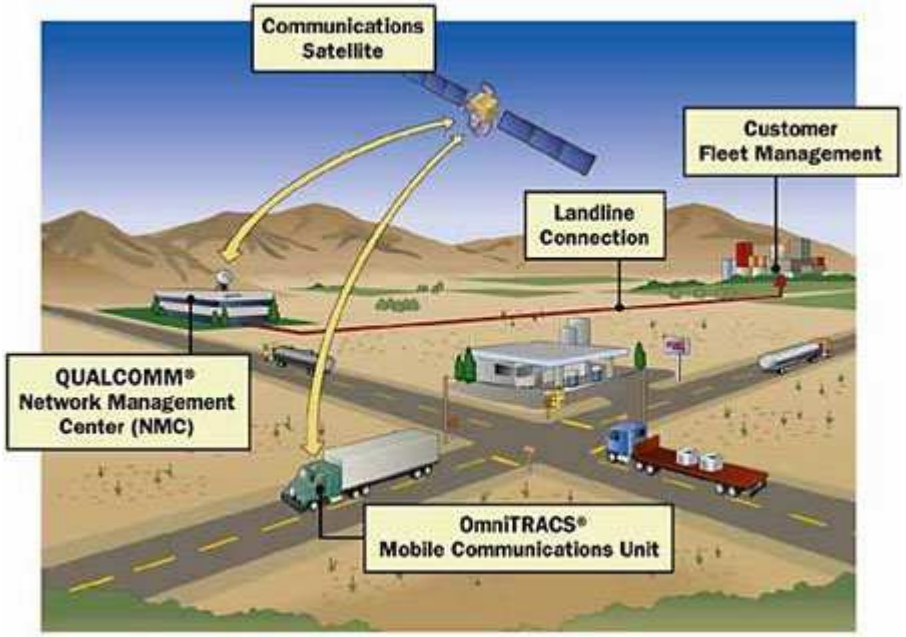
Euteltracs 1/2

- This is the only known mobile system that utilises a standard Ku band GEO satellite.
- EutelTRACS™ was the first mobile communications service via satellite specifically developed for fleet management.
- Each mobile unit is equipped with a small shielded antenna, a rugged on-board terminal with keyboard and LCD, plus software linking the fleet operator's information system to the EutelTRACS™ Network Management Centre.
- This configuration gives access to EutelTRACS™' five major services which:
  - can locate a vehicle or vessel to an accuracy of 100 metres
  - will transmit alarm and distress messages
  - Enable message exchange between the mobile terminal and base (up to 1900 characters max)
  - will collect and transmit data from the vehicle or vessel
  - and enable the mobile terminal to access external databases for weather or traffic conditions.

Complex system

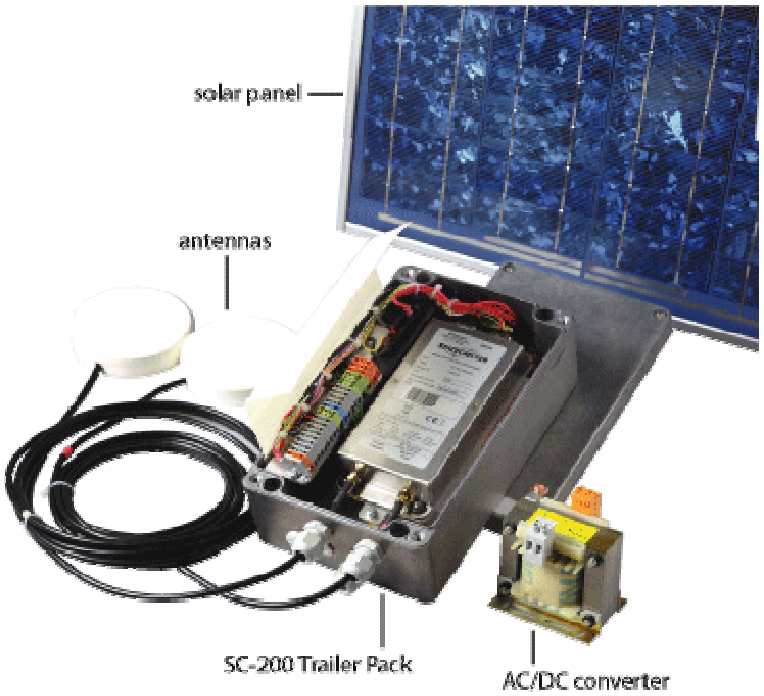
High latency

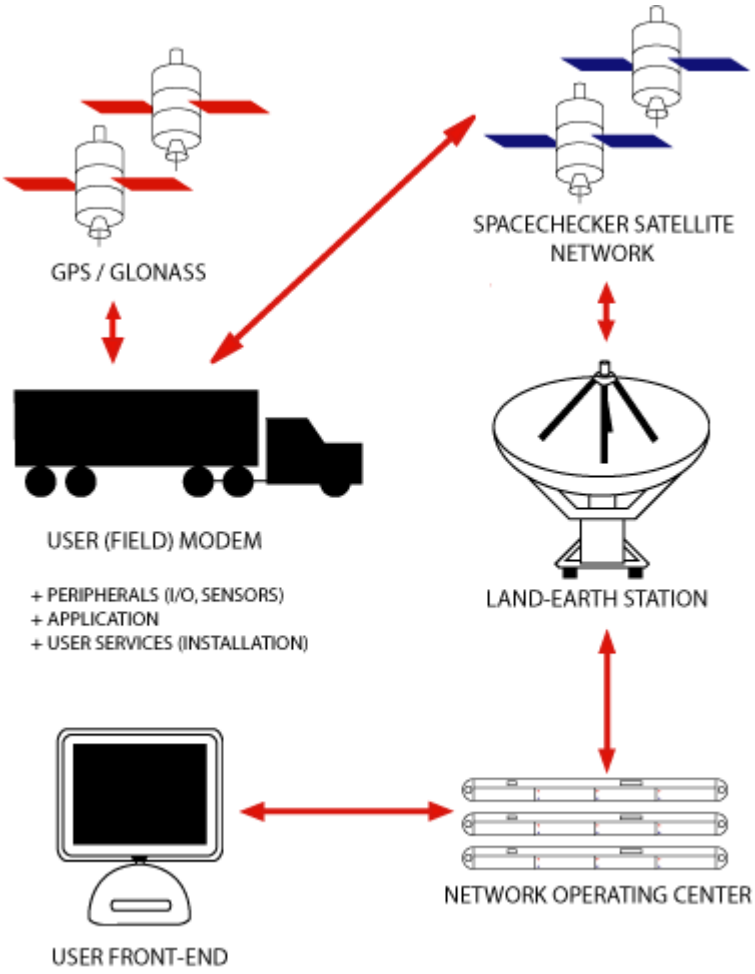
Tracking antenna on vehicle



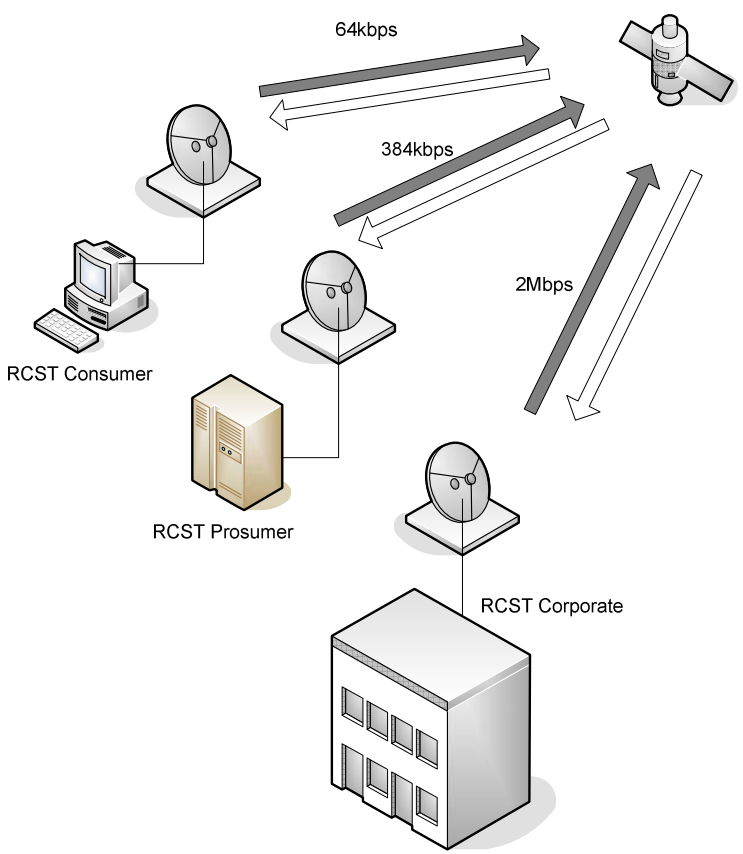
Spacechecker 1/2

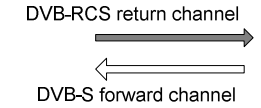
- Similar to Globalwave
- Gateway in Belgium
- Telemetry and command on vehicles and containers

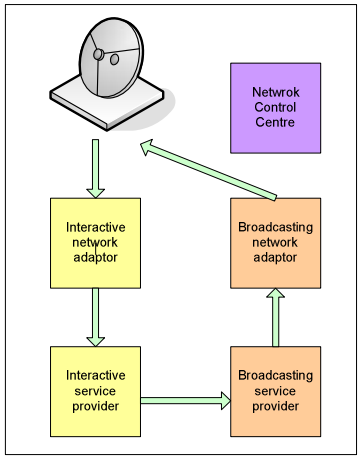




Spacechecker 2/2







Limited application for location based services

Can function as local hub

Proprietary Broadband system Vendors

Supplier	Product name	DVB-S and RCS standard compatibility	Where Deployed
Viasat	Linkstar	DVB-S compatible on forward link. Proprietary return link based on DVB-RCS. Presently development work taking place to make return link DVB-RCS compliant.	Worldwide
Aloha Networks	Sky-DSL	DVB-S forward channel, proprietary return channel	Unknown
Viasat	Arclight	Return channel uses Code Reuse Multiple Access (CRMA) and Paired Carrier Multiple Access (PCMA). Can be used with DVB-S forward channel systems	Arclight Not yet deployed and development suspended. PCMA widely used.
Gilat	Skystar Advantage & Skyblaster	DVB-S compatible on forward link. Proprietary return link	Worldwide
Hughes Network Systems	Direcway	Similar to DVB-S on forward link (Hughes DSS). Proprietary return link.	USA, South America

1980 1990 2002

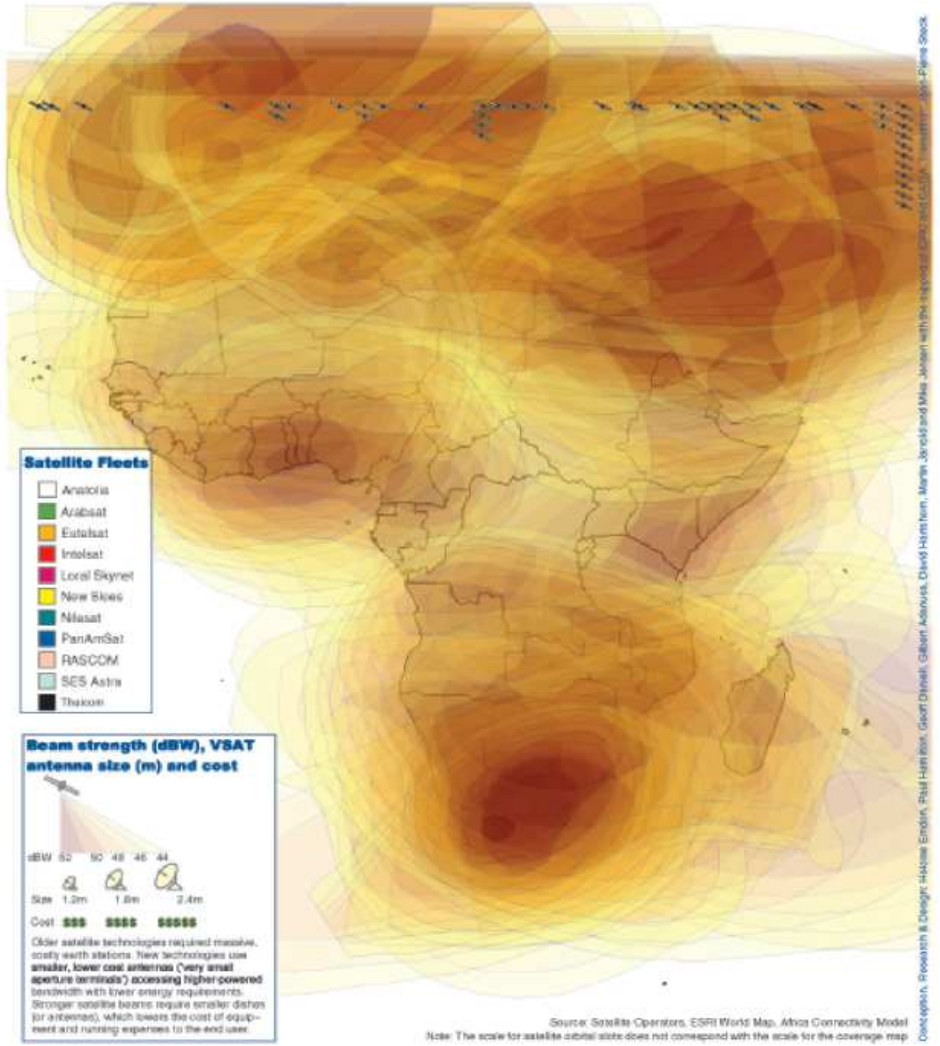
1st Generation: $10-20K, ≤ 64 kbps, Data

2nd Generation: $5-10K, ≤ 2 mbps, V+D

3rd Generation

($1-10K, up 40 mbps,Multimedia)

Coverage


Satellite Fleets
Anatolia
Arabsat
Eutelsat
Intelsat
Local Skynet
New Skies
Nilesat
PanAmSat
RASCOM
SES Astra
Thaicom
Beam strength (dBW), VSAT antenna size (m) and cost
dBW 52 50 48 46 44
Size 1.2m 1.8m 2.4m
Cost $$$ $$$$ $$$$$
Older satellite technologies required massive, costly earth stations. New technologies use smaller, lower cost antennas ('very small aperture terminals') accessing higher-powered bandwidth with lower energy requirements. Stronger satellite beams require smaller dishes (or antennae), which lowers the cost of equipment and running expenses to the end user.
Source: Satellite Operators, ESRI World Map, Africa Connectivity Model
Note: The scale for satellite orbital slots does not correspond with the scale for the coverage map

Other terrestrial wireless

- **iBurst**
- **Sentech MyWireless**
- **Wimax**
- **Wifi**
- **VHF radios FleetCall (>10 000units 51% transtel): Get map from site?**

- **Major drawback:**
  - Coverage
  - Mobility

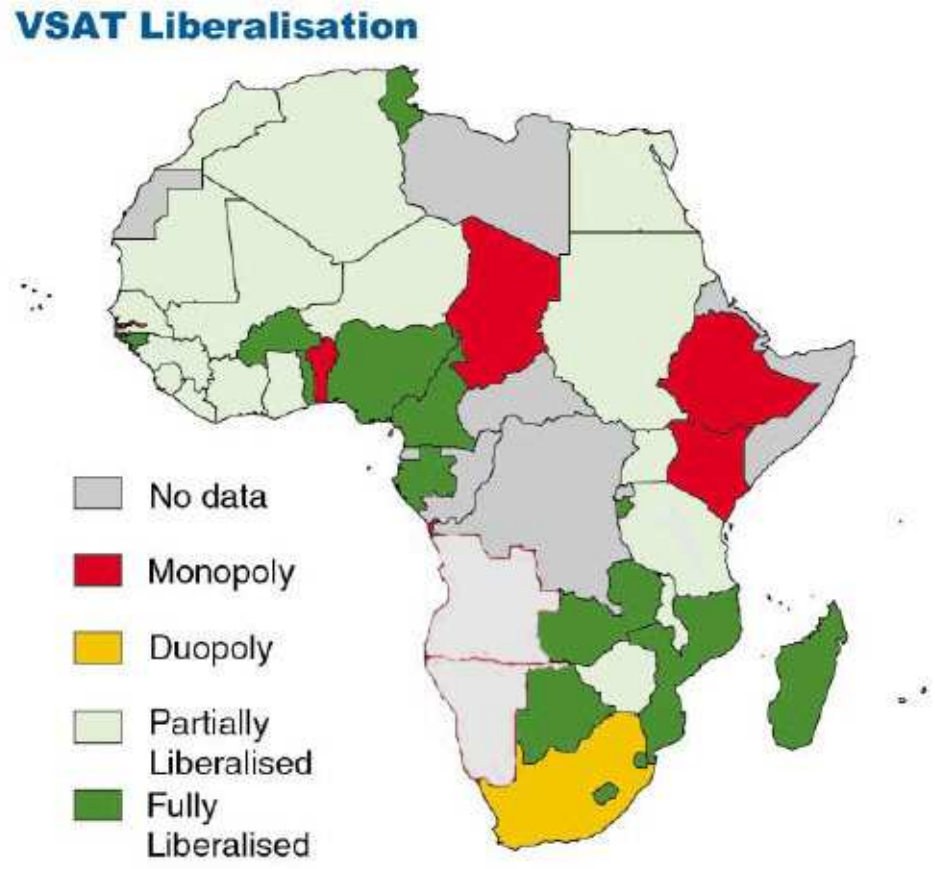
Some applications do not need wide coverage or integration into wider network

Inmarsat products licensed in

Orbcomm soon

VSAT through incumbents

GSM through incumbents



As regulatory environment changes more options available

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Thank you

Open discussion

CSIR THALES