



# LOW-COST TELECOMMUNICATIONS AND ELECTRONIC TRANSFER SYSTEMS

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- **Advantages of Satellite Communications**
- **Systems**
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# ADVANTAGES OF SATCOMS

- **Wide coverage**
- **Broadcast capability**
- **High communications capacity**
- **Flexibility in network set-up**
- **Mobility**
- **Rapid deployment**
- **Reliability**
- **Economic solutions available**



Source: ESA

# COVERAGE (INTELSAT)



Source: INTELSAT

# ADVANTAGES

- **Satellites provide truly global coverage**
  - GEO satellites exclude polar regions
  - LEO satellites cover polar regions as well
- **As recently shown in natural disasters, satcom provide the only reliable communications**
  - GLOBALSTAR satellite phones currently sell by the thousands in the southern states of the US after the disaster



# TECHNOLOGY

# DVB-S

- **Digital Video Broadcast standard**
- **Adopted nearly in all parts of the world (except US and Japan)**
- **Any kind of digital data can be transferred**
- **Multiplex of MPEG-II video/audio and IP packets**
- **Very low-cost hardware for about \$ 50 available (PC card)**
- **Plugs into existing PC or laptop**
- **Dish + receiver front-end for another \$ 50**

# DVB-S2

- **Benefits from recent developments in transmission technology**
- **Powerful error-correction coding**
- **Fade-mitigation to overcome impairments of the channel due to unfavourable propagation conditions (rain storms)**
- **Typically 30-35 % capacity increase over DVB-S under same transmission conditions**



# SUPPORTED APPLICATIONS

- **Delivery of high quantities of data (multicast)**
  - ➔ Image transfer
  - ➔ Intranet / Internet access (downloads)
- **Broadcast-quality TV (MPEG-II compressed)**

# SIT – INTERACTIVE TERMINAL

- **DVB – RCS (Return Channel System)**
- **Digital Video Broadcasting Technology (DVB-S,-S2)**
  - forward link Ku-, C-band
  - High bit rates: several Mbit/s
  - typ. in Ku-band (normally used for TV distribution)
- **Return link**
  - C-, Ku- or Ka-band
  - Data rates 144, 384, 2048 Mbit/s
- **Star network, large number of terminals**
- **Designed for high-speed Internet access in areas without DSL or cable connectivity**

# SIT

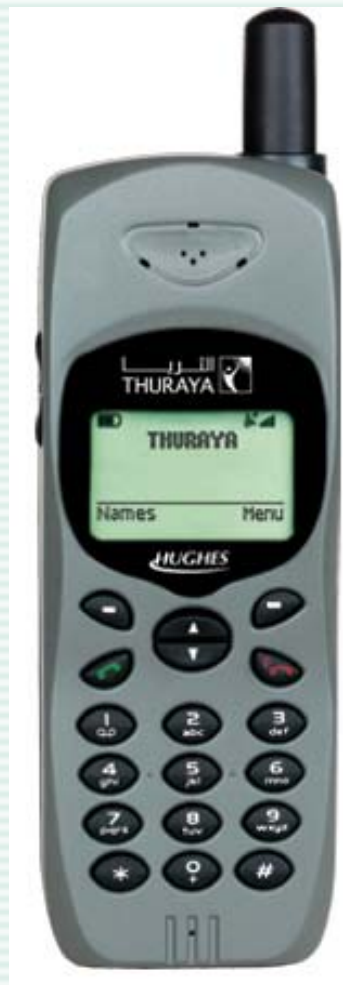
- Dish sizes: 75, 90, 120 cm
- Small transceiver front-end
- Small indoor equipment
- Lower cost compared to traditional VSATs
  - Terminal: around € 1500
- Self-aligning dish (azimuth, elevation, polarization) needed for installation by non-experts



# THURAYA SATPHONE

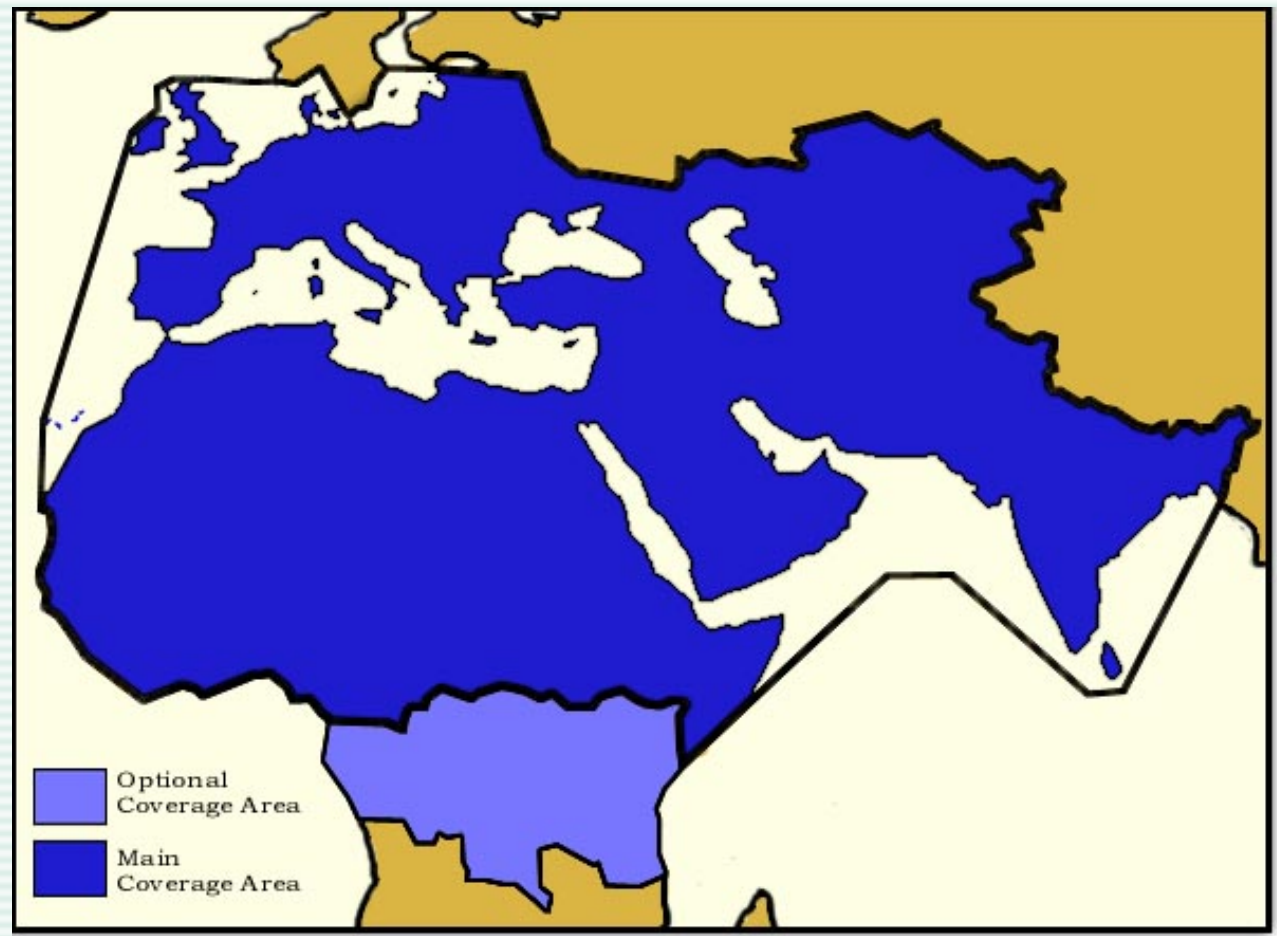
- **GSM-compatible**
- **Can be used as terrestrial phone in reach of GSM network**
- **In remote areas communications via satellite**
- **9.6 kbit/s data services**
- **In combination with DVB multicast system, high-speed downloads possible**

# THURAYA TERMINAL



Source: THURAYA

# THURAYA COVERAGE



Source: THURAYA

# ORBCOMM

- Store-and-forward messaging system
- LEO constellation
- World-wide coverage
- Not real-time
- VHF band (137/148 MHz)
- Serial data interface



Source: ORBCOMM

# INMARSAT BGAN

- **Laptop-sized terminal**
  - ➔ 1.6...1.8 kg
  - ➔ 30x24x4 cm
- **400 kbit/s data rate (two-way)**
- **Wide coverage**
- **Price estimate: \$ 1...1.5 / min.**



# BGAN TERMINAL

- 1) Integral antenna
- 2) Compass
- 3) SIM card
- 4) Battery
- 5) External power
- 6) USB
- 7) Indicators
- 8) Ethernet



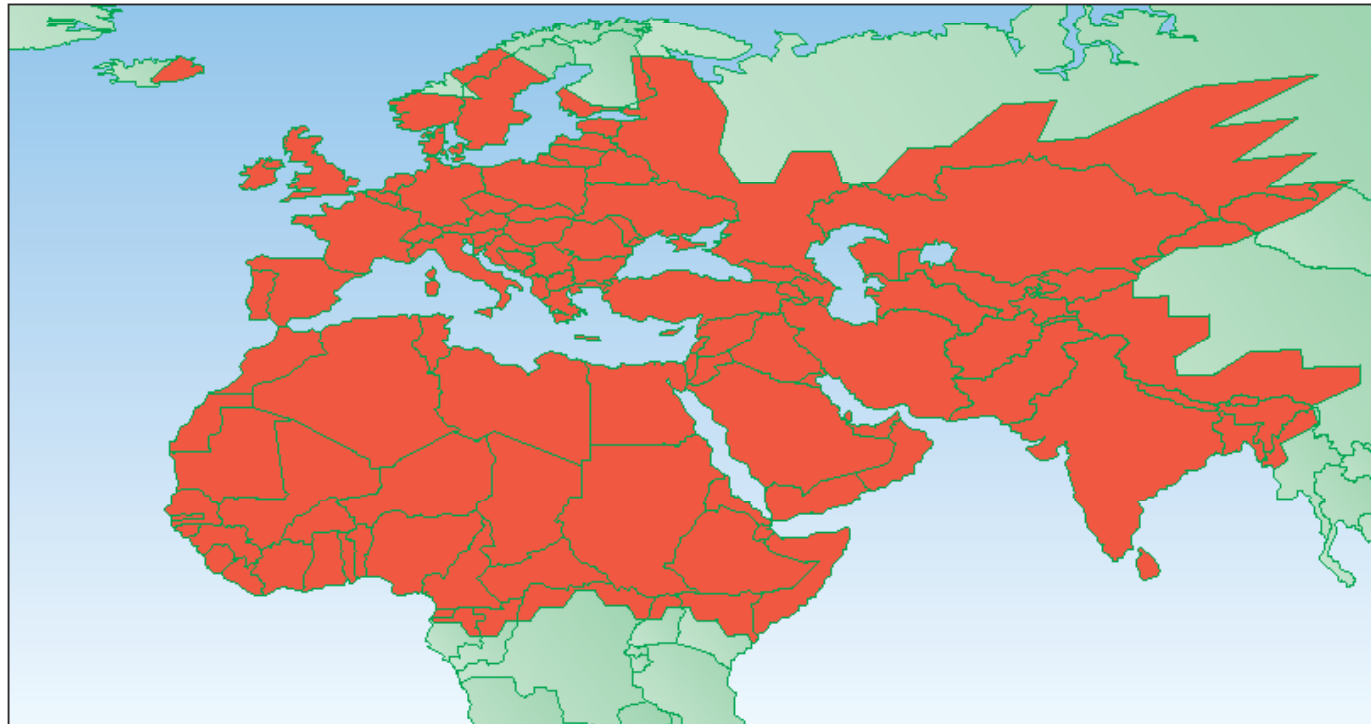
Source: INMARSAT




# INMARSAT BGAN COVERAGE



## Inmarsat Regional BGAN coverage map



 Inmarsat Regional BGAN coverage

The map depicts Inmarsat's expectations of coverage but does not represent a guarantee of service and should not be relied on. The availability of service at the edge of coverage areas fluctuates depending upon a variety of conditions and is subject to licensing.

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Source: INMARSAT

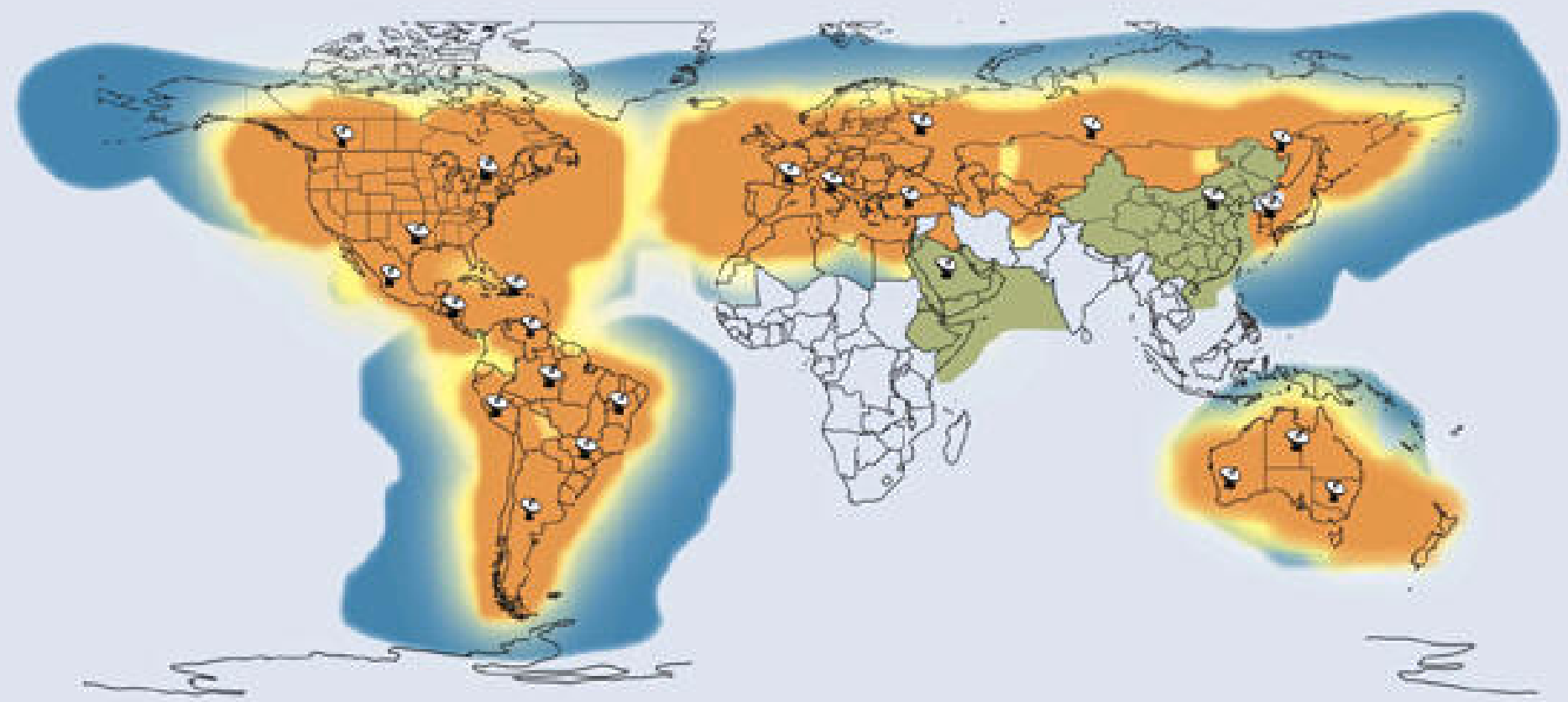
# GLOBALSTAR

- LEO constellation
- Coverage depending on terrestrial gateways
- Satellite phone with data capability (9.6 kbit/s)



Source: GLOBALSTAR

# GLOBALSTAR COVERAGE



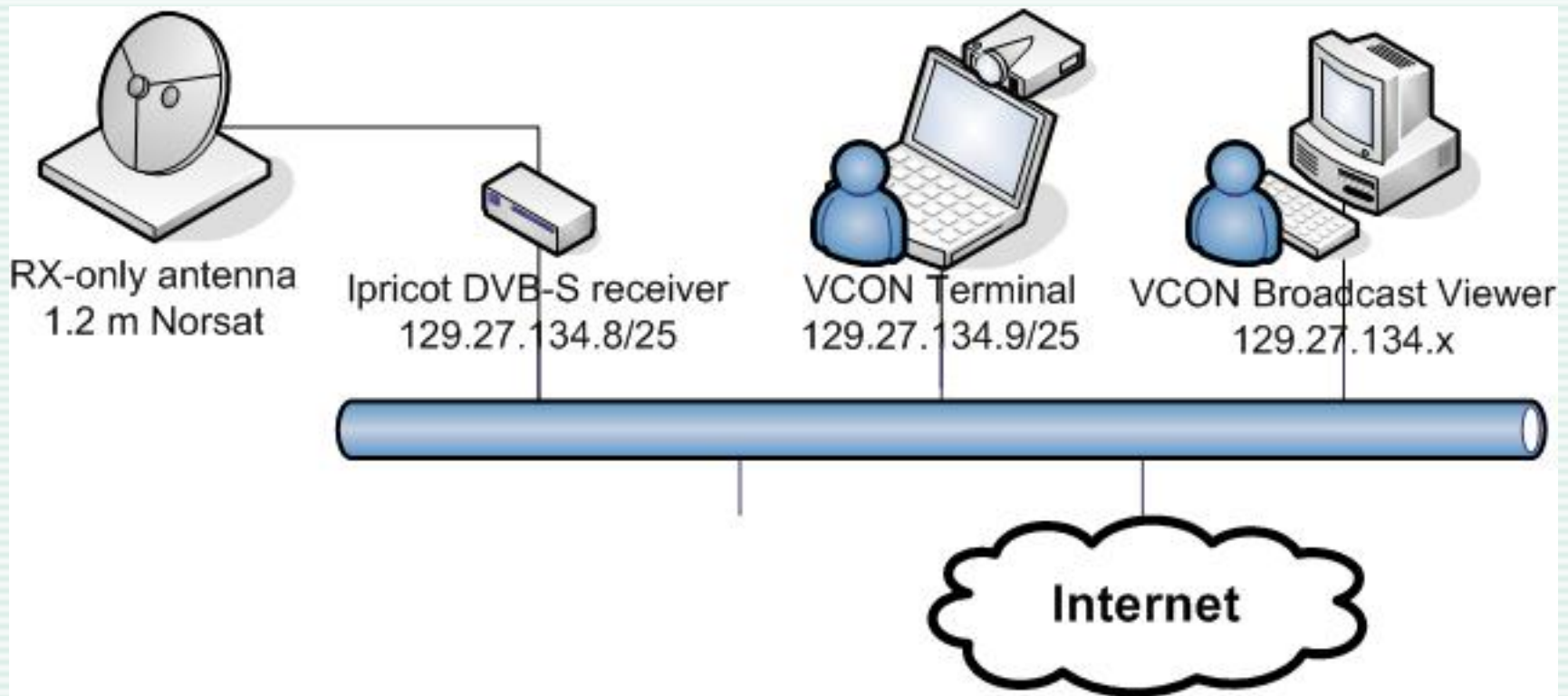
# HYBRID SYSTEM

- **DVB-S high-speed forward link**
- **Satphone data return link**
- **With proper protocols fairly high-speed download possible**

# SATNEX PLATFORM

- **Based on DVB-S forward link**
- **Hub station at Fraunhofer Institute**
- **Content delivery via terrestrial Internet**
- **Return link via Internet**
  - ➔ Video conference
  - ➔ Chat
  - ➔ VoIP
- **Multipoint feature provided by conference server**

# ARCHITECTURE



# EQUIPMENT





# MULTIPOINT CONFERENCE



Austria

Germany



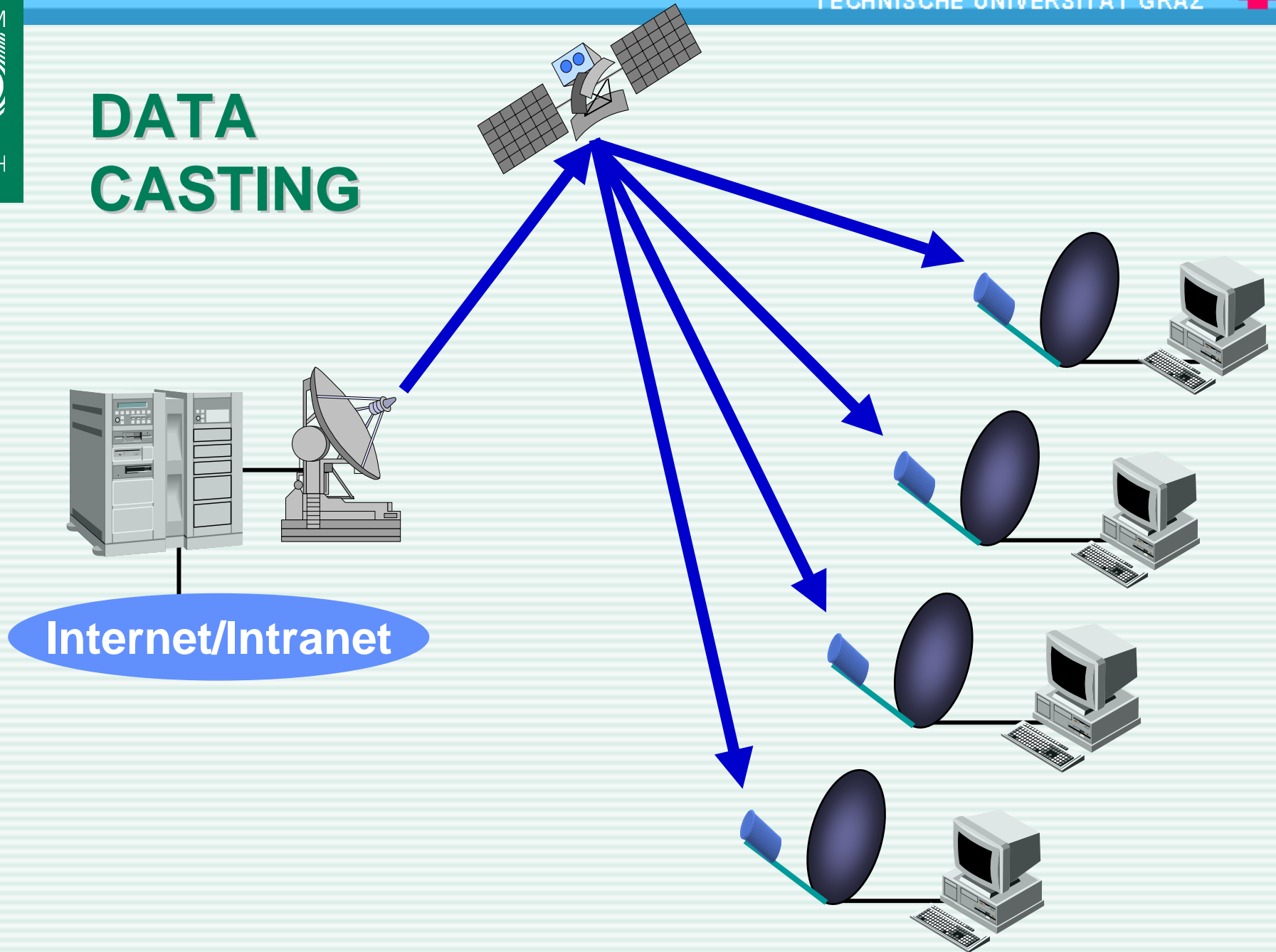
UK

# INTERNET/INTRANET VIA SATELLITE

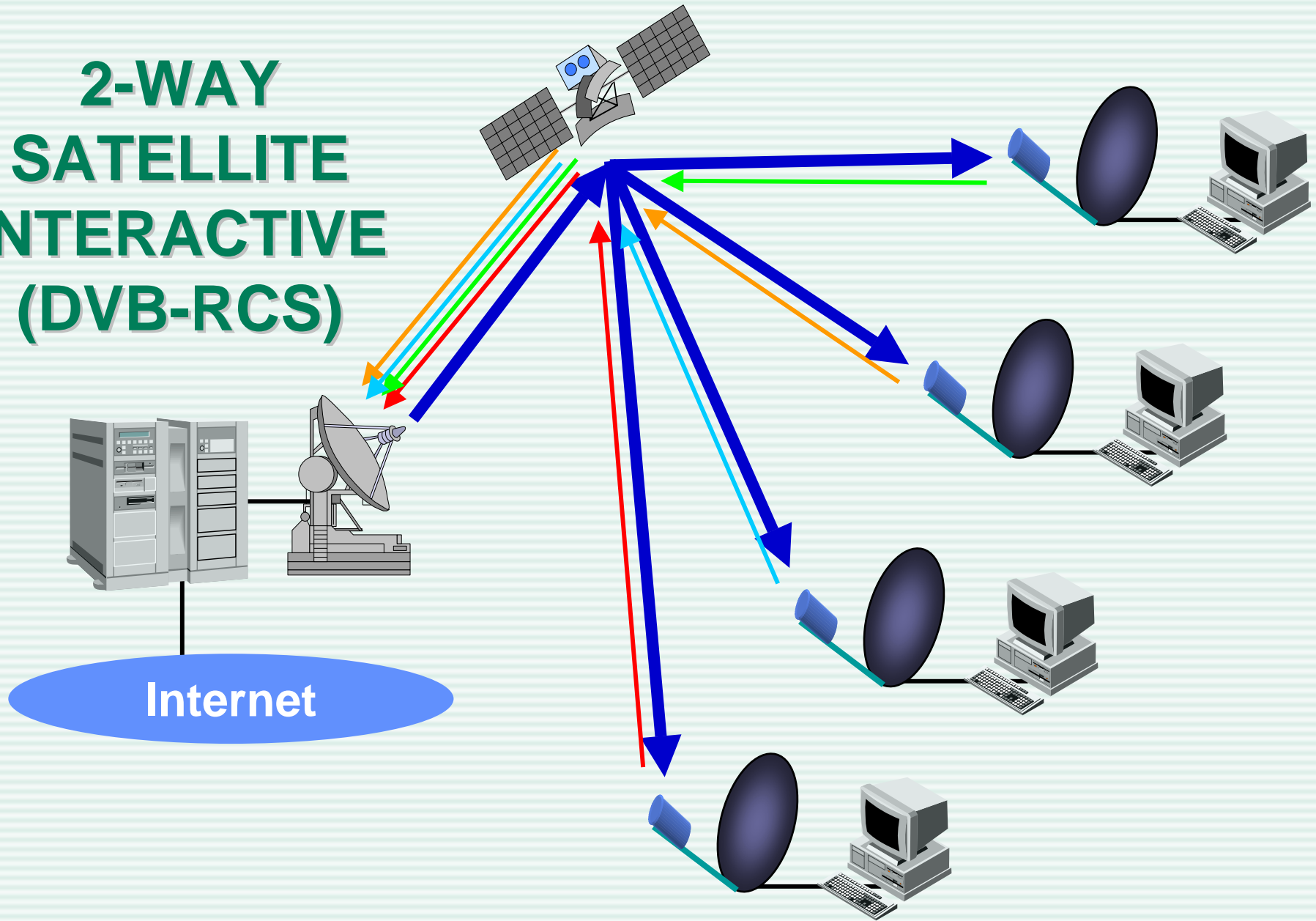
# SATELLITE INTERNET/INTRANET ACCESS, DATACASTING

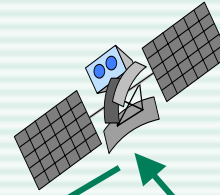
- **Transport of IP packets via DVB (forward link)**
- **Return link**
  - ➔ via terrestrial networks
  - ➔ via satellite
- **Improvement of telecom infrastructure in rural areas**
- **Low-cost solutions**

# DATA CASTING



# 2-WAY SATELLITE INTERACTIVE (DVB-RCS)





DVB Transmitter

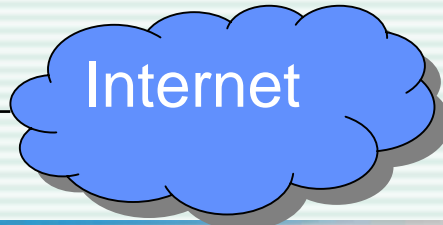


Satphone

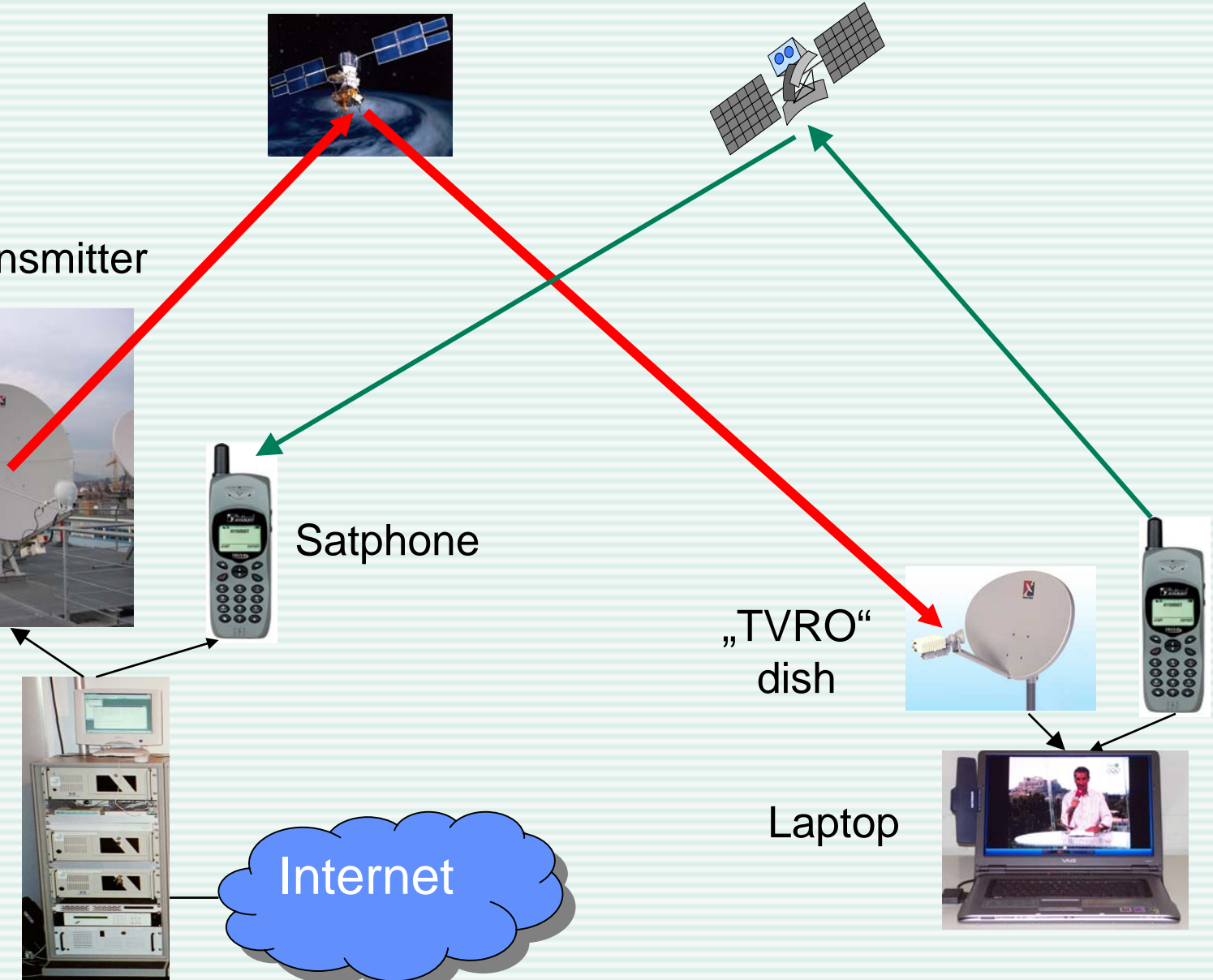
„TVRO“  
dish



Server



Laptop





# NETWORKING ASPECTS

## ■ Suitable for

- High-speed data transmission (remote sensing images)
- Intranet / Internet access
- Data collection (larger volumes)

## ■ Direct terminal – terminal communications limited due to double hop

## ■ Solution: On-board processing

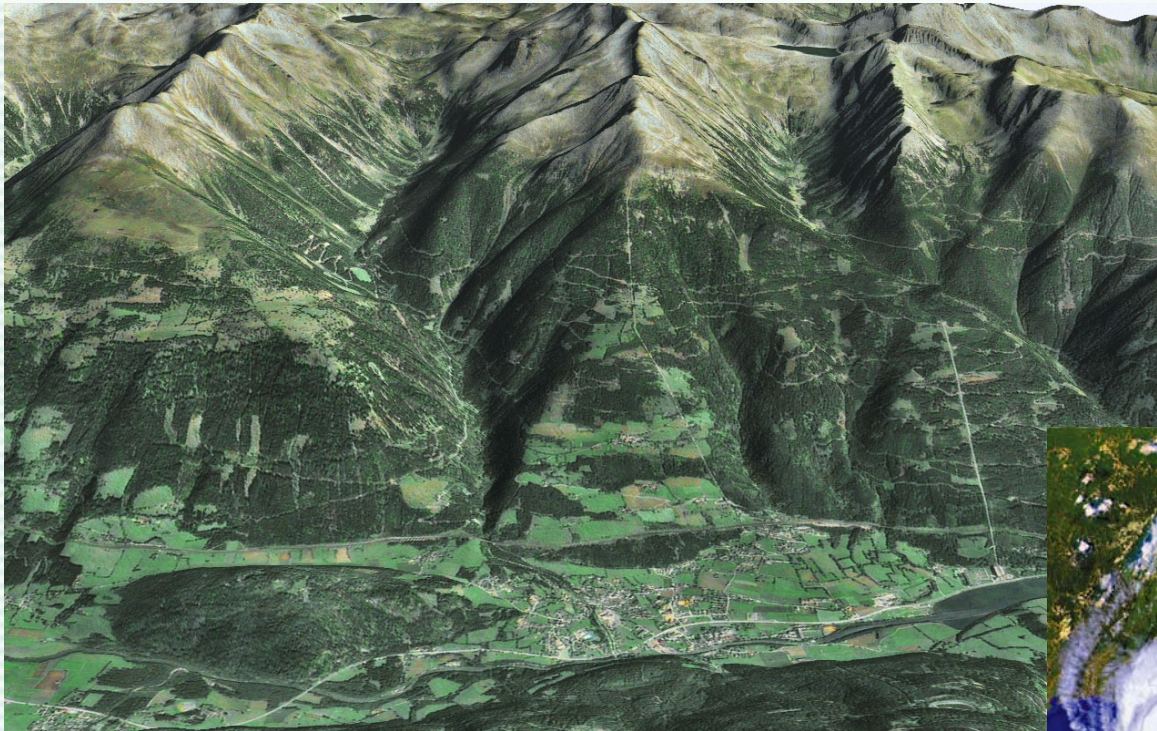
- „switching in the sky“
- HISPASAT AMAZONAS satellite (South American coverage)

# SERVICES

- **High-speed file transfer**
  - ➔ Meteorological, remote sensing images
- **Database access**
- **Intranet / Internet access from remote areas**
- **Email**
- **IP telephony**
- **Sensor networks**
- **Integrated decision support system**



# REMOTE SENSING IMAGE TRANSFER



# SUMMARY

## ■ **Satellite communications indispensable tool for**

- High-speed data collection & dissemination
- Voice/video/data when other communications links are disrupted
- Integrated decision support systems
- Sensor networks

## ■ **Symmetrical and asymmetrical solutions**

## ■ **„All IP“ networks facilitate integration**

- Satellite
- Microwave links
- WLAN

## SUMMARY (2)

- **Provision of services in remote areas**
- **Rapid deployment**
- **Reliable systems**
- **Low-cost solutions available using DVB technology**



# WEB SITES

■ [www.joanneum.at/ias](http://www.joanneum.at/ias)

■ [www.iks.tugraz.at](http://www.iks.tugraz.at)