



Services and Applications

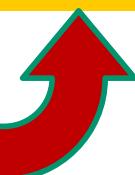
Why to use satellite?

From being a problem due to delay

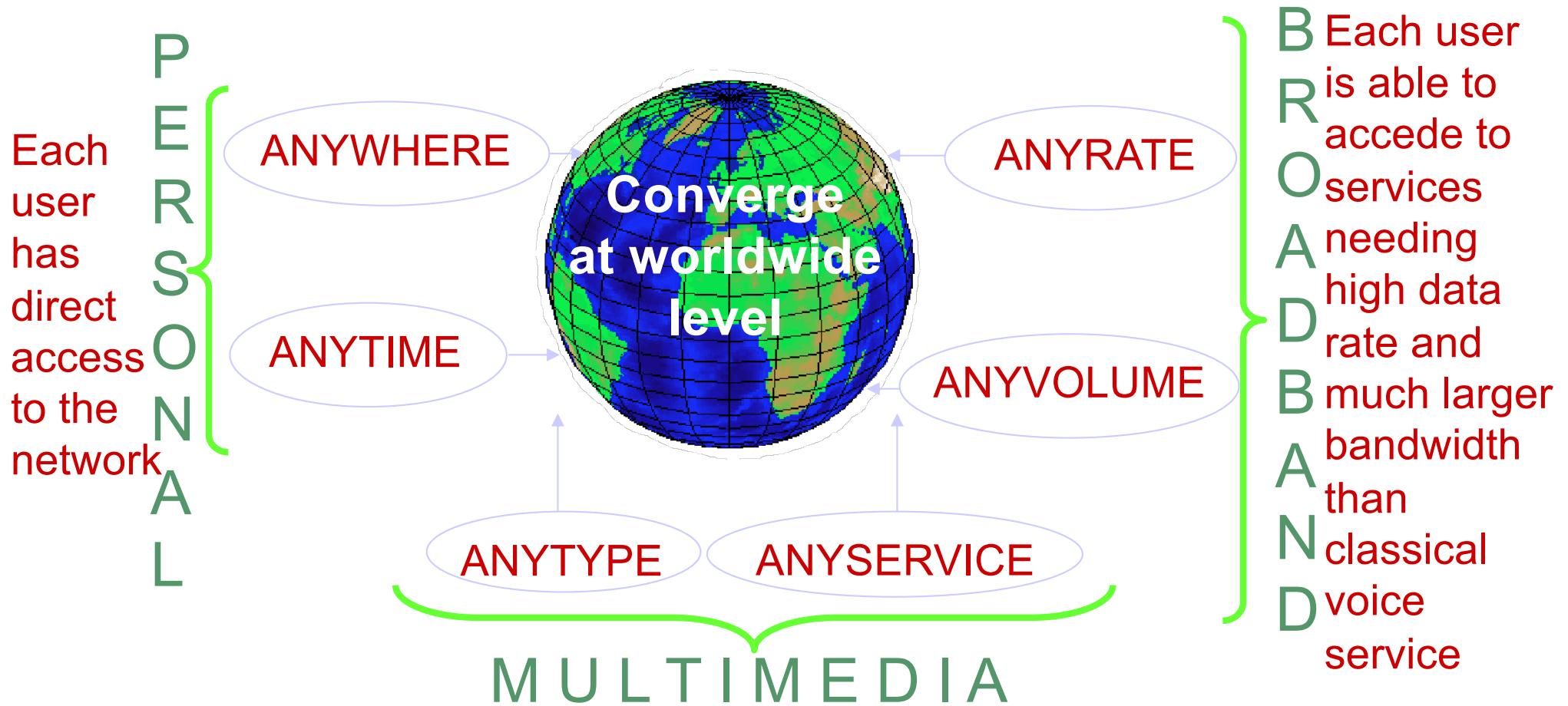
- € Costs independent on distance (within one satellite coverage)
-  Collecting and broadcasting characteristics
-  Particularly suitable and cost effective for multicasting
-  Irreplaceable in areas with scarce or no infrastructures
-  Irreplaceable in case of disaster
-  Suitable for large coverage areas and long range mobility
-  Relatively short deployment time
-  Flexible architecture
-  Bypass very crowded terrestrial networks
-  With the same infrastructure both fixed and mobile services

- Disruptive to feed CDN nodes
- Efficient to distribute security keys

to being the element that can meaningfully contribute to achieve the “zero latency” and to efficiently face the multi-domain issue

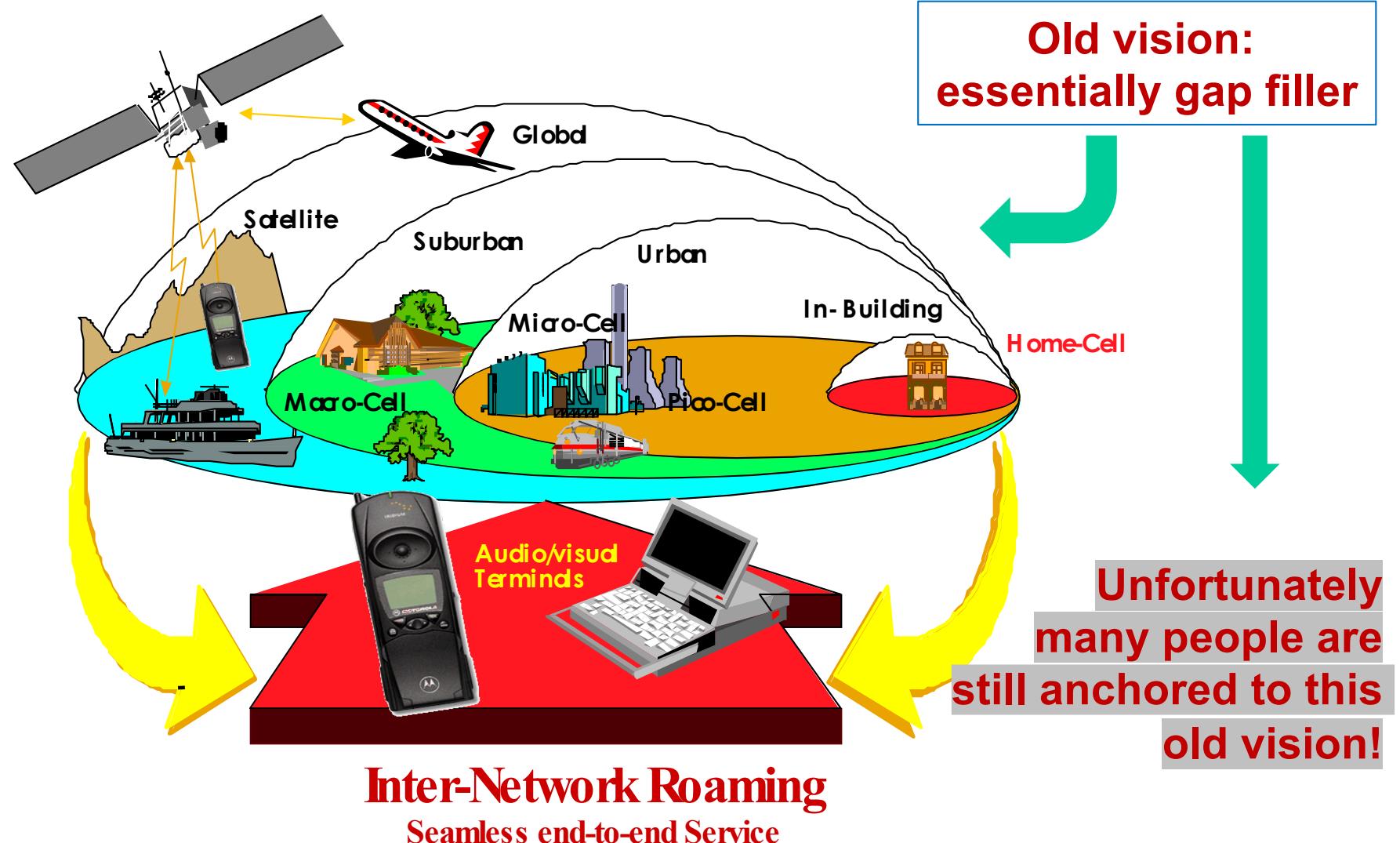


Multimedia/Personal/Broadband Communications



Each user is able to accede to links to make use of different services characterized by different data rates and QoS (data, voice, video) through the same terminal

Satellite role in the global communication scenario



Multimedia/Personal Satellite Services

Rationale

- Global Information Infrastructure (GII) to every individual
- Broadband services

Services

- Global Internet services
- Interactive/multimedia video
- Tele-medicine
- Distance learning
- Interactive home banking/shopping
- Satellite news gathering
- Disaster management
- Support to vertical sectors (e.g. transportation)
- Mobile broadband multi-play services
- Feed Content delivery networks
- etc.

Internet Application Layer Protocols

User Application	IP Application Protocol
World Wide Web Browsing	HTTP/TCP
Electronic Mail	Simple Mail Transfer Protocol, SMTP/TCP
File Transfer	File Transfer Protocol, FTP/TCP Trivial File Transfer Protocol, TFTP/UCP
Remote log-in	Remote Terminal Protocol, Telnet/TCP
Network Management	Simple Network Management Protocol, SNMP/UDP
Data Multicasting	MFTP/UDP
Voice/Video Conferencing	UDP

Multimedia Services and Applications

SERVICE	APPLICATION	USER TYPOLOGY	BANDWIDTH	INTERACTIVITY
Messaging	PC networking	Business	Medium	High
	E-mail	Residential, Business	Small	No
	Paging	Residential, Business	Small	No
	Instant messaging	Residential, Business	Small	High
Information retrieval	Data base access	Business	Large	Medium
Telephony	Voice, data, etc.	Residential, Business	Medium	High
Video-communication	Videophone	Residential, Business	Medium	High
	Videoconference	Business	Very large	High
	Video Streaming	Residential, Business	Large, Medium	No/Low
Video-information (VOD)	Telemedicine	Residential	Medium	High
	Tele-education	Residential, Business	Medium	Medium
Broadcasting	Analog TV Digital TV (DVB) HDTV Analog Radio Digital Radio (DAB)	Residential, Business	High	No

Quality of Services

Application	Quality (BER)	Max end to end Delay	Data rate	
			<i>forward</i>	<i>return</i>
PC networking	10^{-6}	200 ms	64 kbit/s	64 kbit/s
E-mail	10^{-4} - 10^{-6}	5 min	1-5 kbit/s	1-5 kbit/s
Paging	10^{-4} - 10^{-6}	5 min	1-5 kbit/s	1-5 kbit/s
Data Base access	10^{-6}	500 ms (file transfer)	2 Mbit/s	100 kbit/s
Telephony	10^{-3} - 10^{-4}	250 ms	64 kbit/s	64 kbit/s
Videophone	10^{-6}	200 ms	64 kbit/s - 1 Mbit/s	64 kbit/s - 1 Mbit/s
Videoconference	10^{-6}	200 ms	64 kbit/s - 2 Mbit/s	64 kbit/s - 2 Mbit/s
Tele-medicine	10^{-6}	200 ms	64 kbit/s - 2 Mbit/s	64 kbit/s - 2 Mbit/s
Tele-education	10^{-6} (data)	200 ms (1s for data)	1 Mbit/s	64 kbit/s

More resources are necessary to satisfy new service requirements

- Search of scarcely utilized bands (L, S, C, Ku, Ka, EHF, V, W)
- Improving spectral efficiency
 - Utilization of the needed bandwidth
 - Granularity
 - Bandwidth on demand
 - Frequency reuse for spatial and/or polarization discrimination
- Improving performance in terms of:
 - EIRP
 - Antenna gain
 - Coding
 - Receiving techniques (demodulation, MUD, etc.)
 - Interference reduction
 - TCP
 - Architecture

Main Technologies for Multimedia Satellite Services

On board antennas

Phased and multibeam antenna

- beam shaping for specific footprint
- focus beams (“hot spots”)
- steerable beams

HPAs and beams forming networks

Reconfigurable output power distribution

- to add flexibility in traffic management
- to improve satellite reliability

Processing satellites

On board processing and inter-satellite links

- to allow single-user routing
- to mix digital traffic typologies

Resource management optimization

- DAMA

Network routing minimization

- Minimum utilization of network resources

Transport protocol improvements

- Burst transmission
- Congestion prediction
- Window growth speed up
- Use of UDP based protocols

Source coding improvement

- MPEG2 to MPEG4

Application

Technological innovations

- Increased on board power
- On board processing
- On board switching
- Multibeam antennas
- Interference reduction
- Intersatellite link
- Digital signal processing
- Small, low cost, low power consuming terminals
- Software radio
- Implementation of impairments (rain, channel) countermeasures
- Protocols
- Ground segment management
- Compression

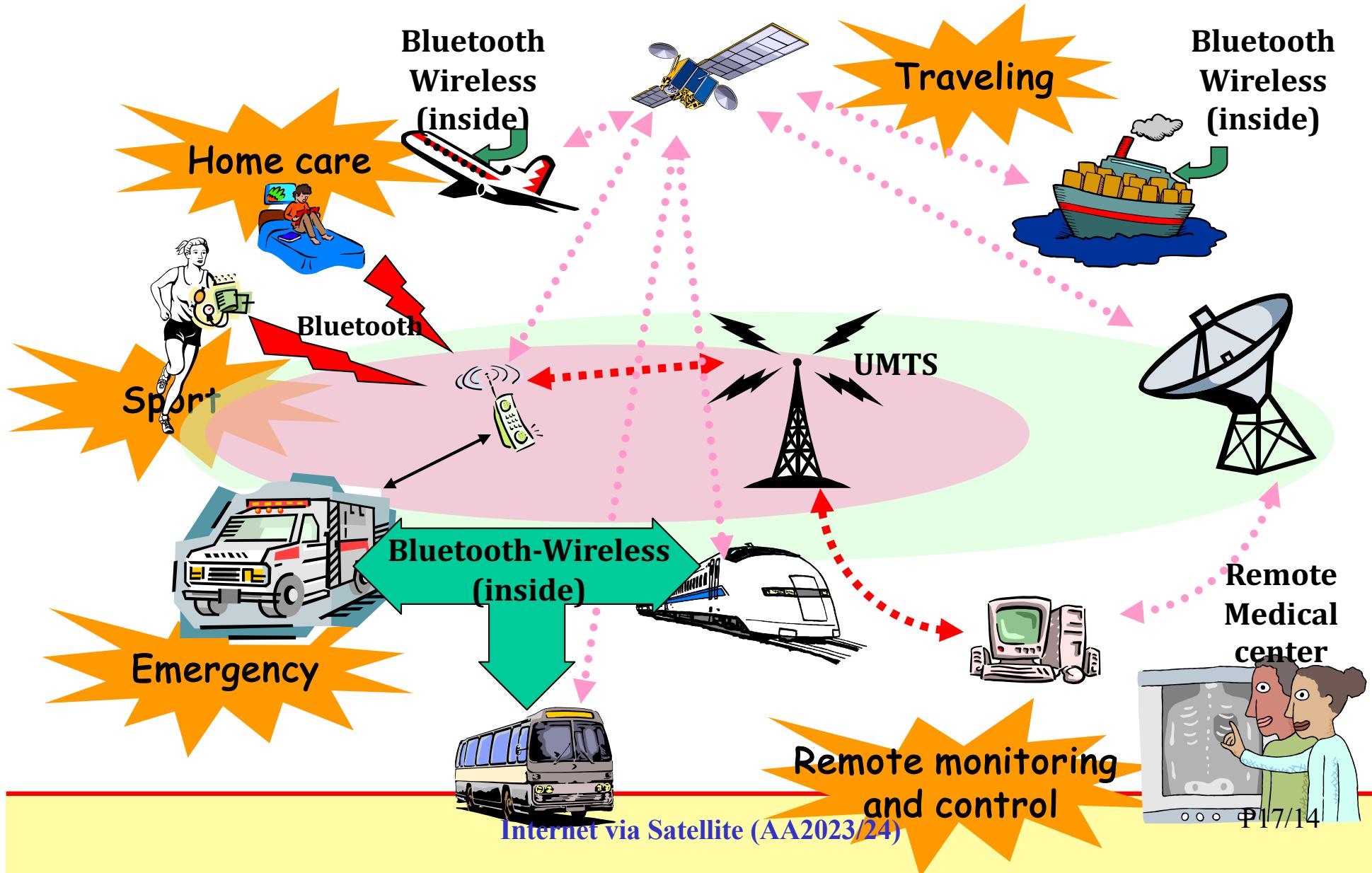


Telecommunications Applications based on Satellite Infrastructure

Telemedicine

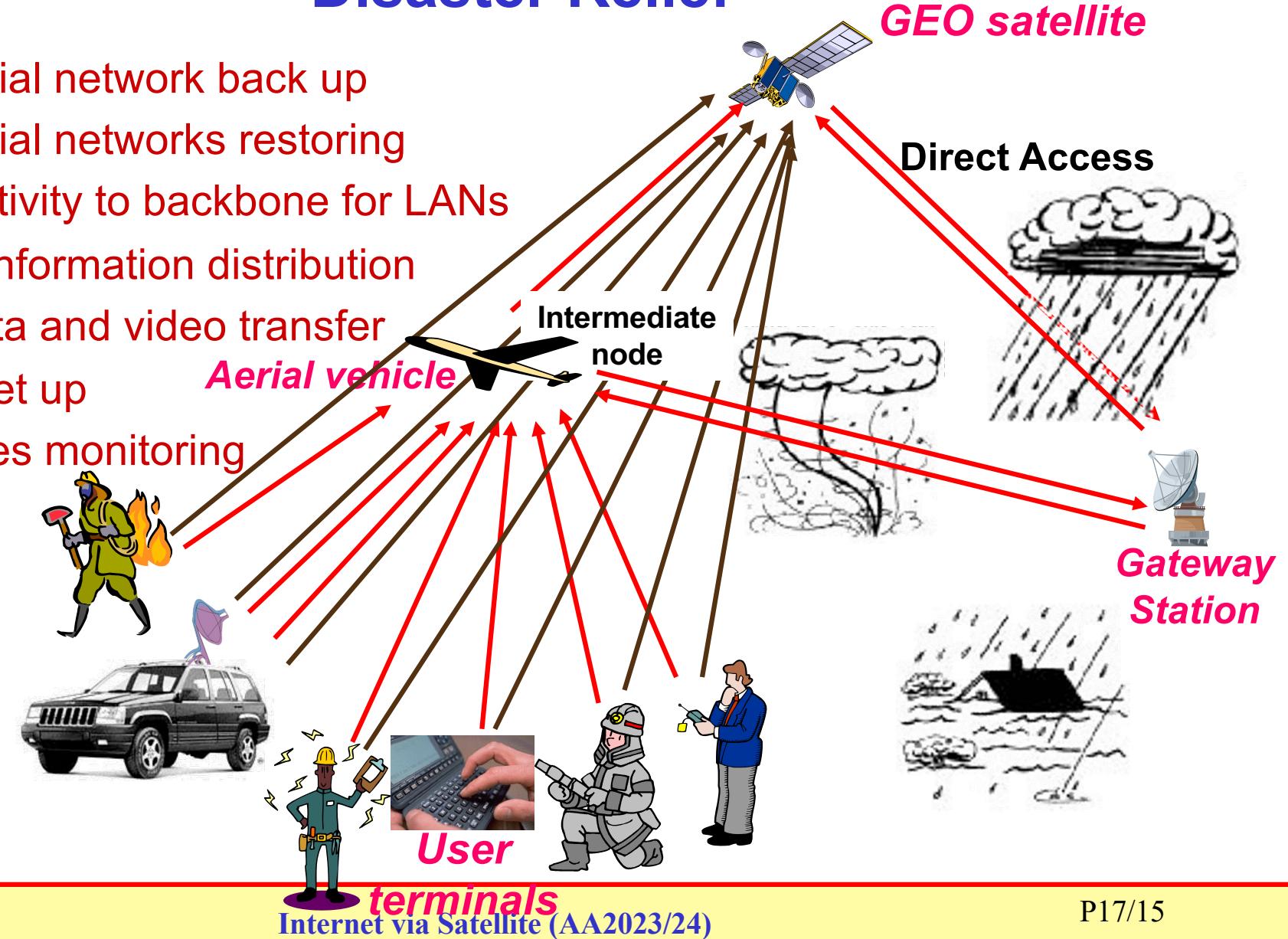
- Bulk data transfer among hospitals and medical centers
- Clinical information sharing
- Remote diagnosis
- Remote surgery (delay sensitive)
- Access to databases
- Home care
- Connection for vehicles (ambulances)

Telemedicine scenario



Disaster Relief

- Terrestrial network back up
- Terrestrial networks restoring
- Connectivity to backbone for LANs
- Safety information distribution
- Bulk data and video transfer
- Quick set up
- Damages monitoring



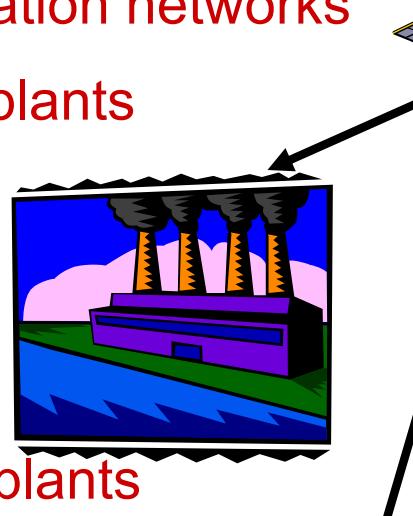
Search and Rescue

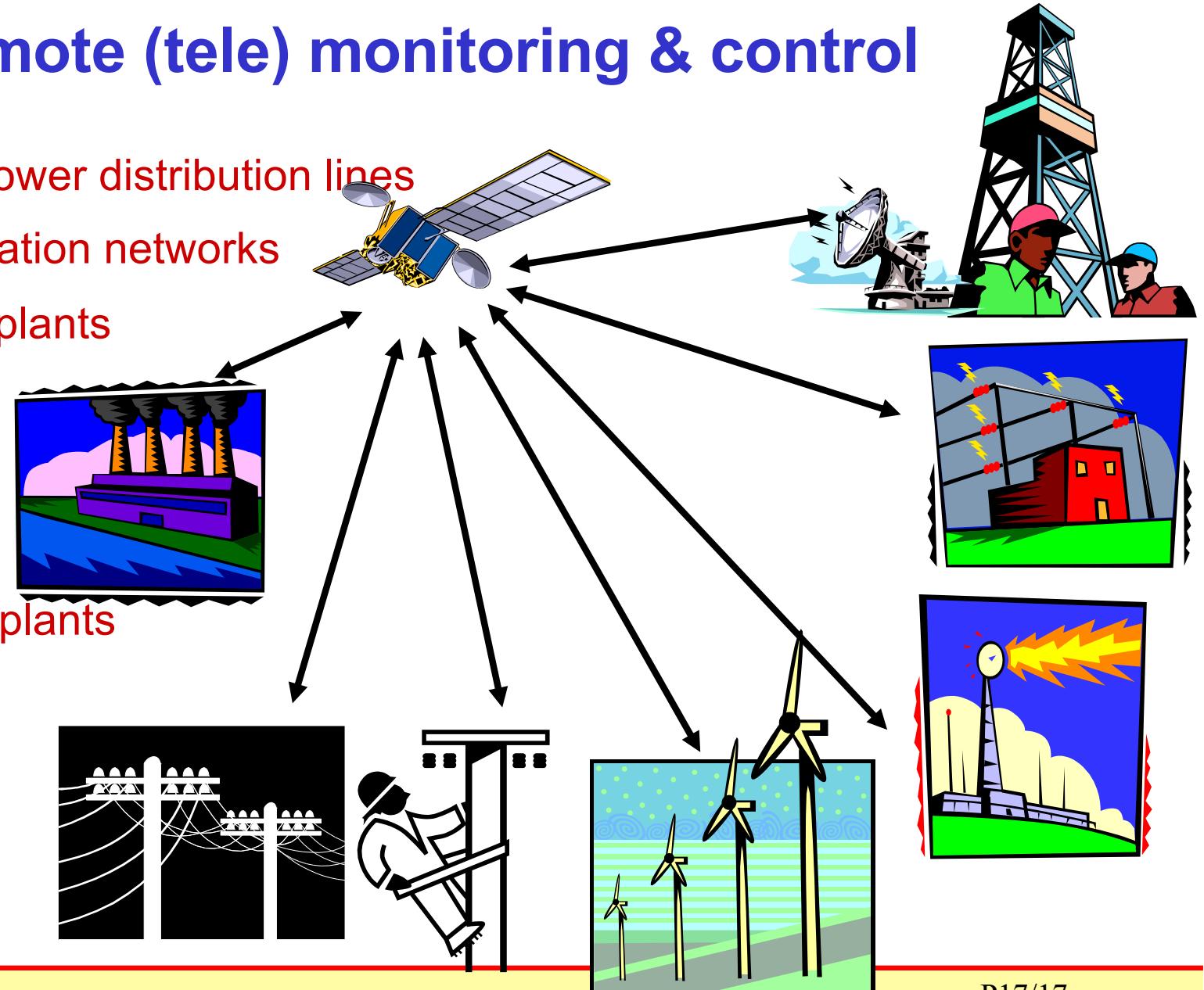
- Team management in impervious location
- Multicast information distribution
- Data exchange

Environmental monitoring

- Monitoring the status of
 - Rivers, volcanoes, lakes, mountains, sea, snow slides
- Prompt fire localization

Remote (tele) monitoring & control

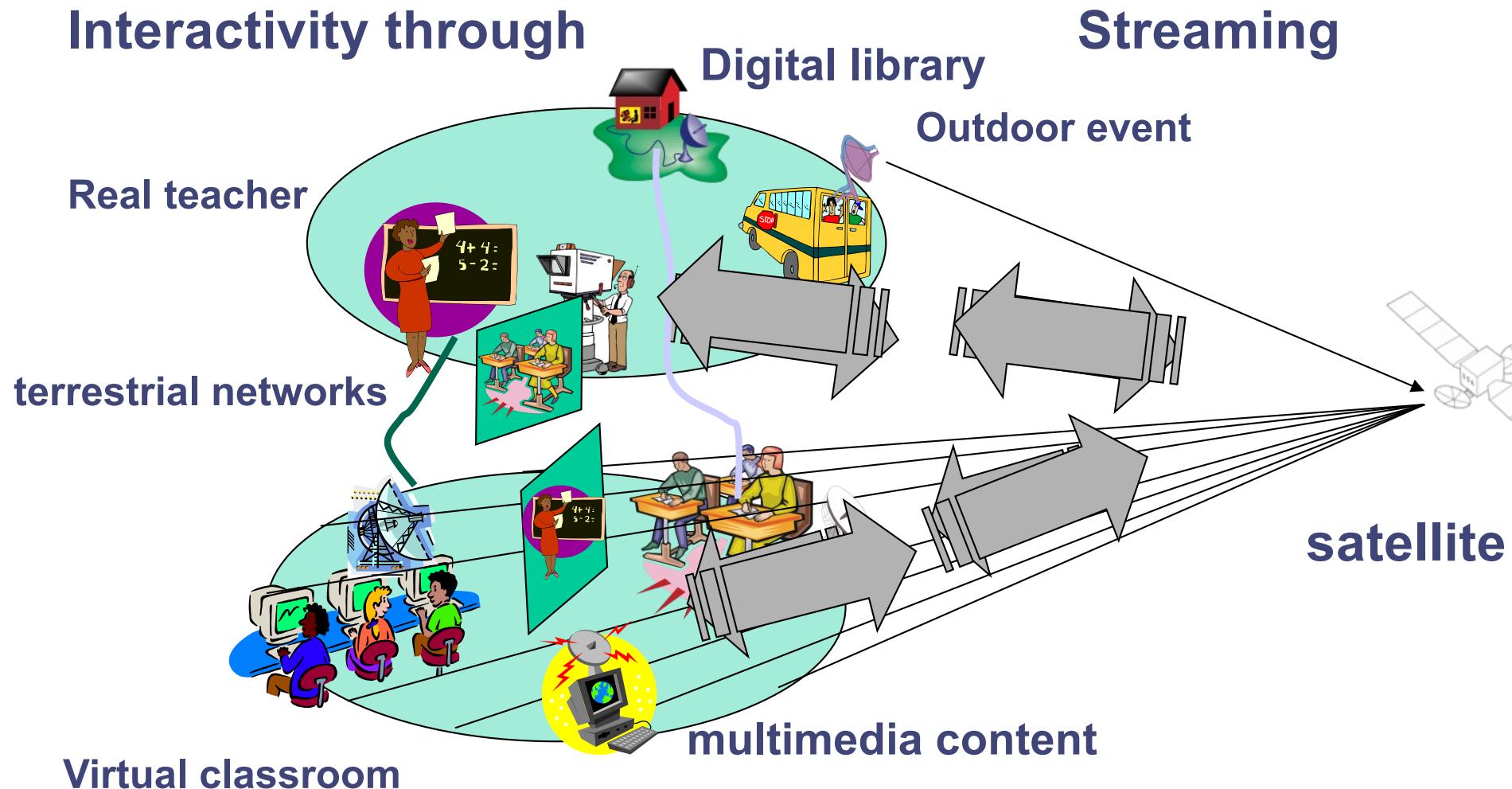
- High voltage power distribution lines
 - Telecommunication networks
 - Technological plants
 - Aqueducts
 - Oil pipelines
 - Gas pipelines
 - Electric power plants
 - DykesA diagram of an electric power plant is shown, featuring a purple building with a blue roof and four orange and yellow striped smokestacks emitting plumes of smoke against a blue sky with white clouds. A thick black arrow points from the top right towards the top of the building. Another thick black arrow points from the bottom right towards the base of the building.



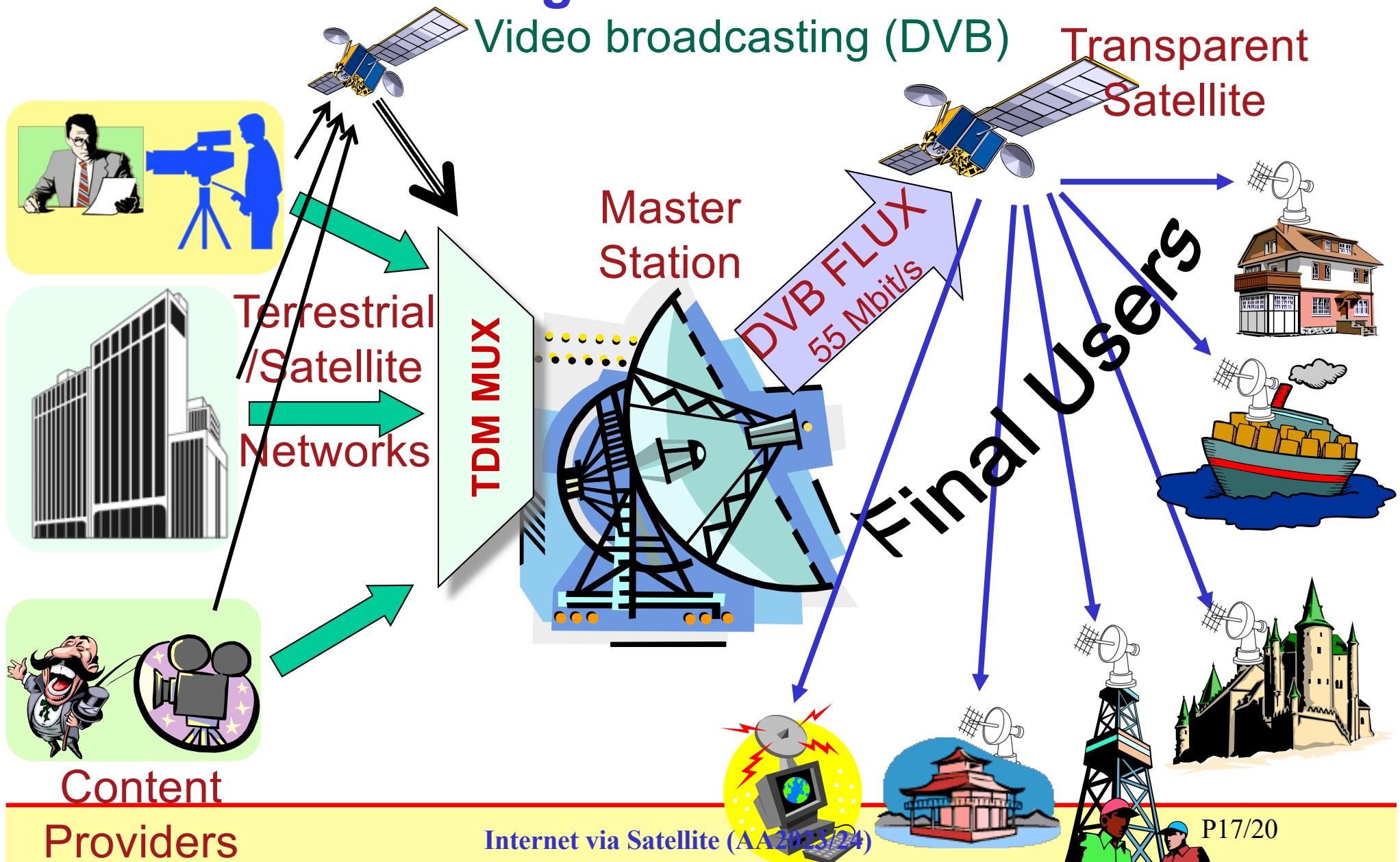
Distance Learning

- Virtual classroom
- Interactivity
 - Low data rate (terrestrial)
 - High data rate (satellite)
- Real time lecture
- Simultaneous view of video, text, white board and presentations
- Multiparty lecture (indoor and outdoor)
- Access to digital libraries
- Access to digitalized multimedia content

Tele-education scenario



Broadcasting traditional architecture



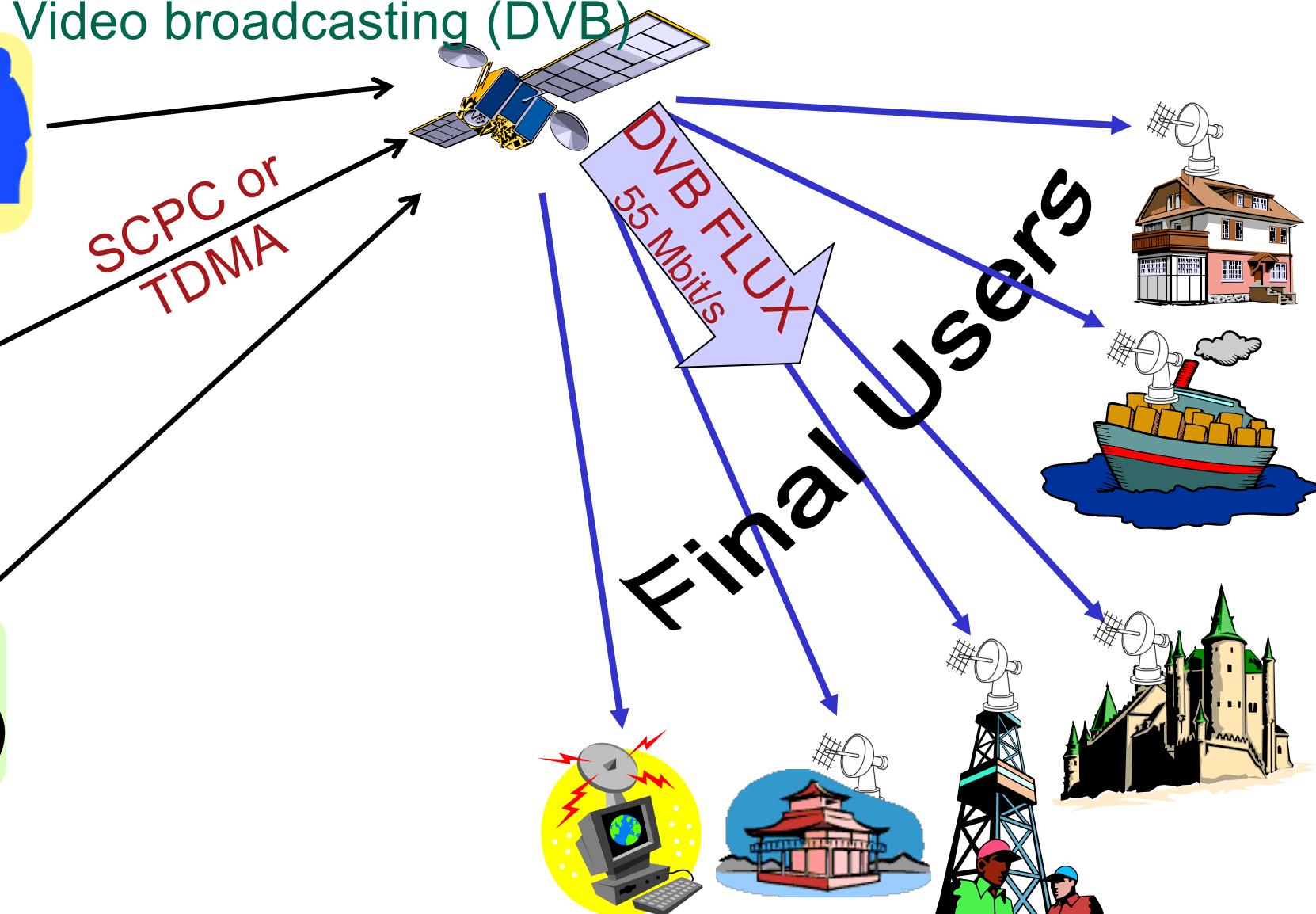
Broadcasting SkyPlex architecture

Video broadcasting (DVB)

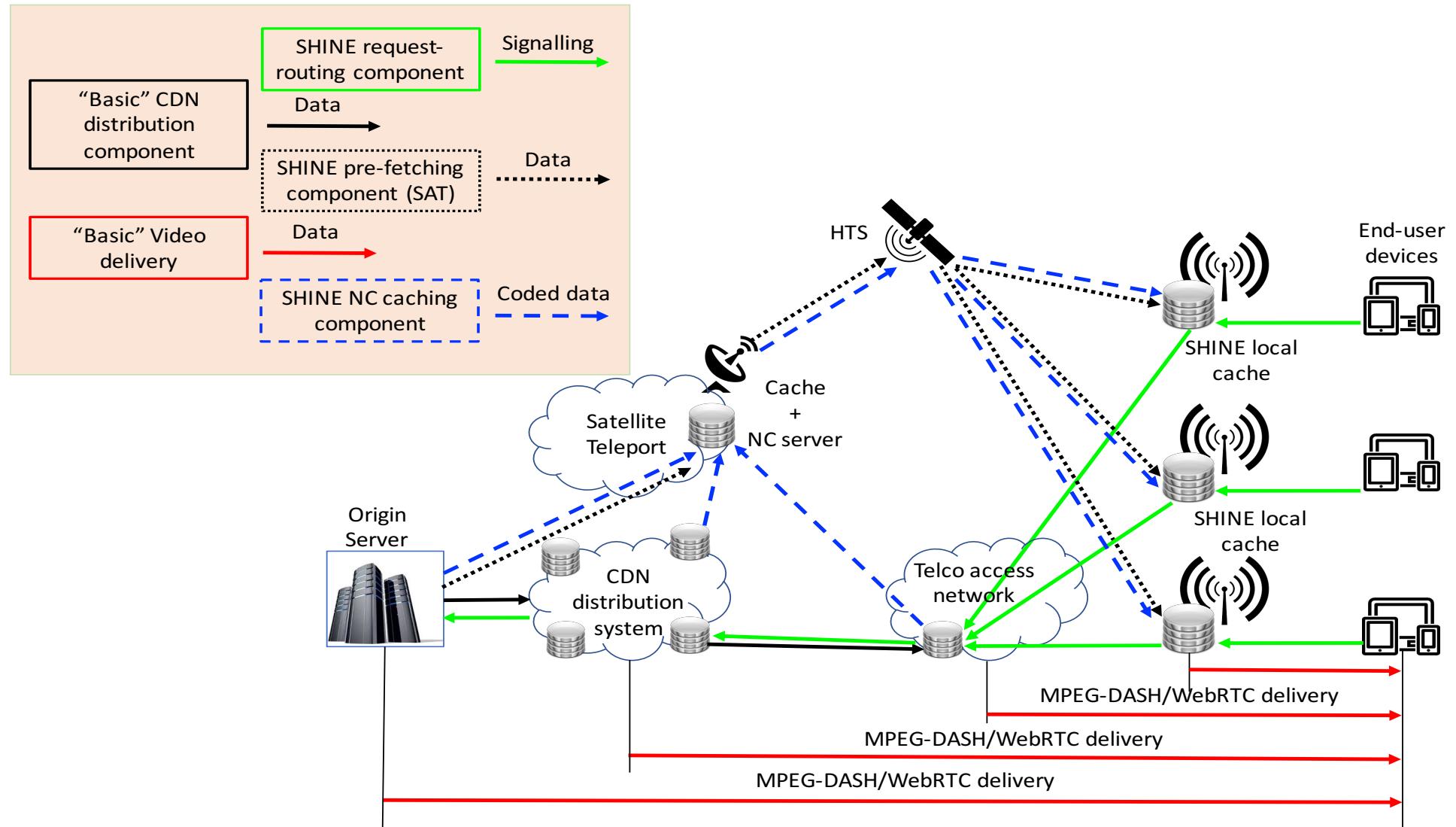


Content Providers

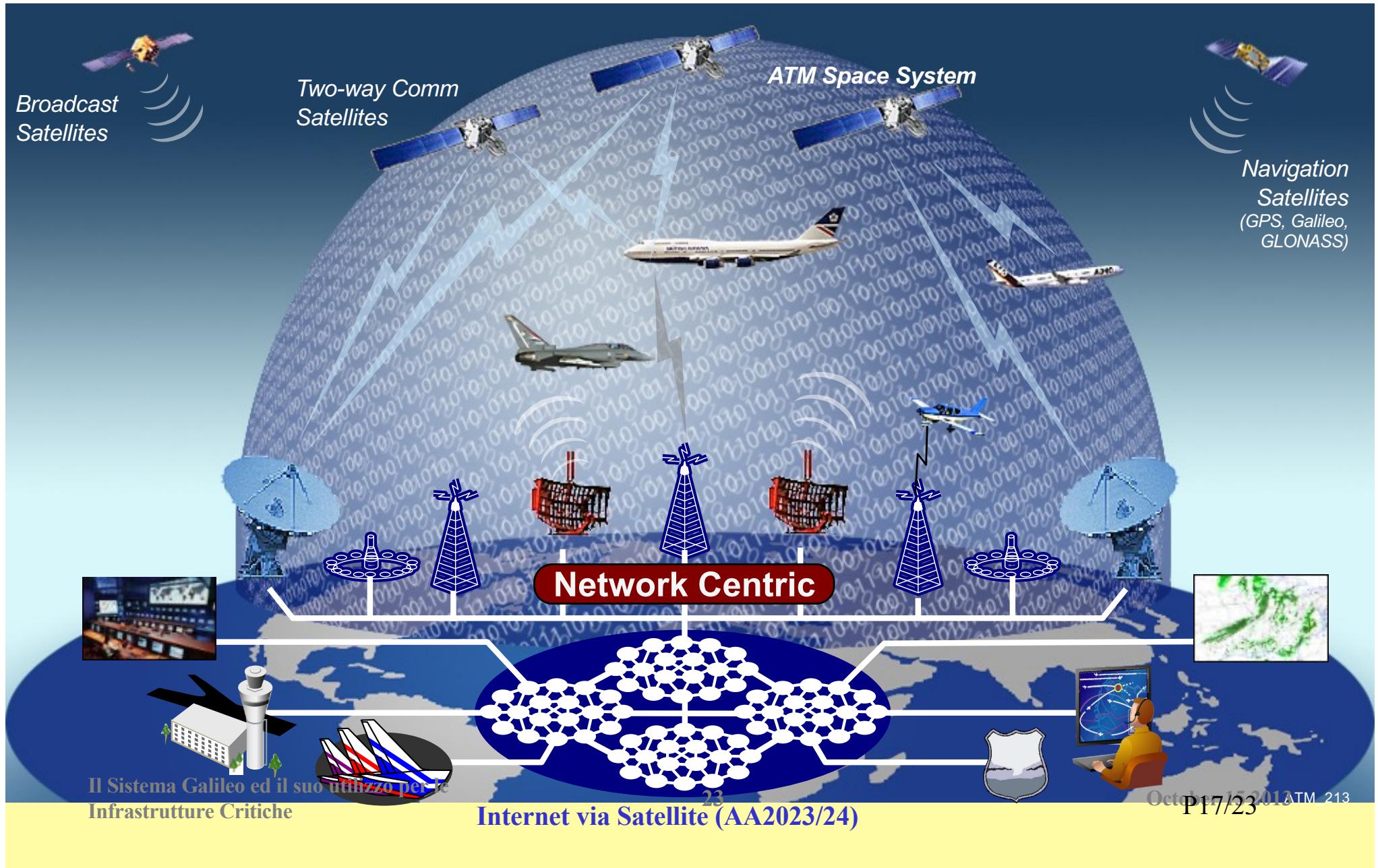
SCPC or
TDMA



Content Delivery Network feed



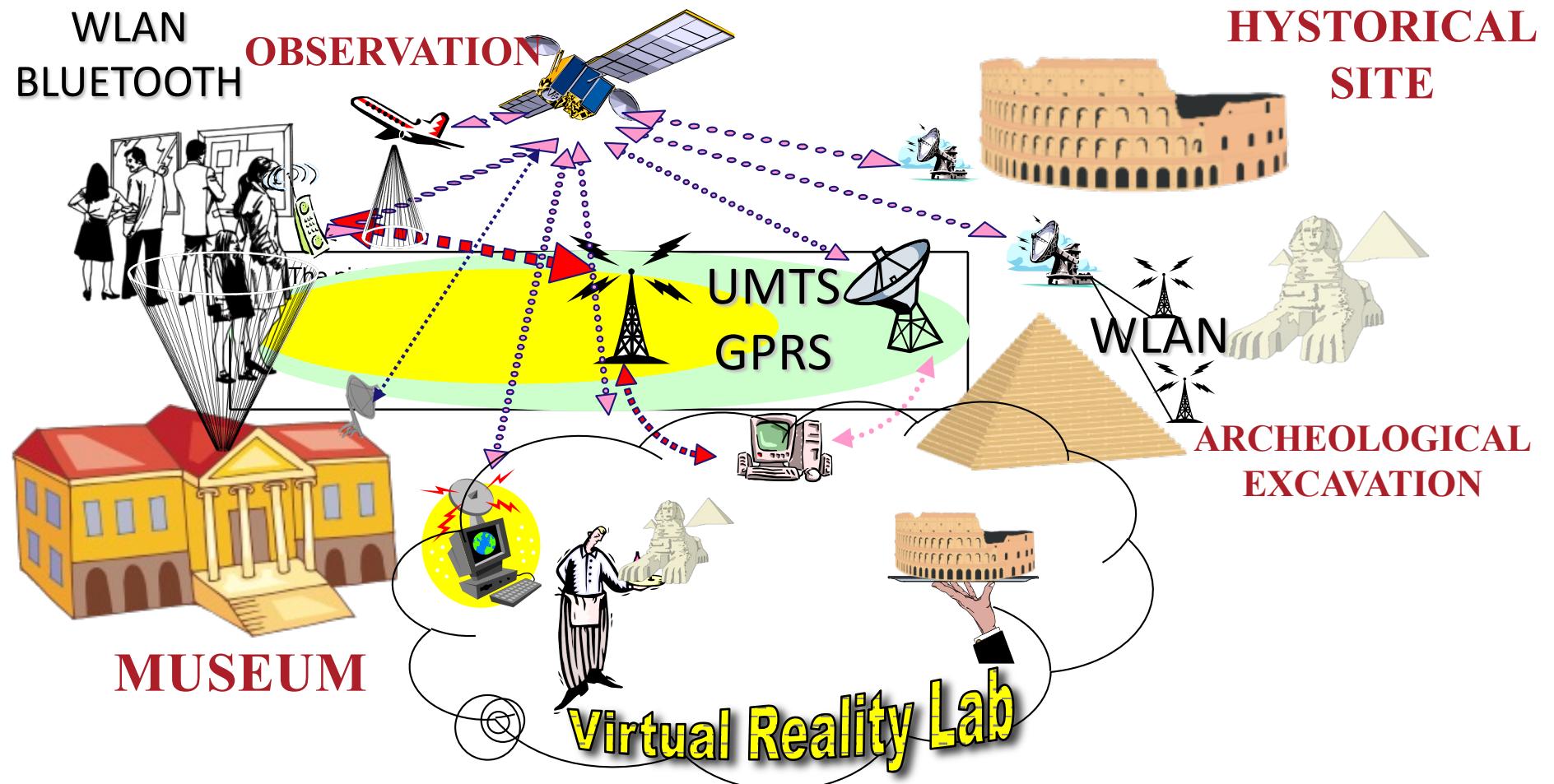
Next Generation Global ATM



Cultural Heritage

- Interconnection of sensors, exchanging data in real time;
- Flexible interconnection of PCs and peripherals;
- Access to data base, consultation of the content of huge data base in real time from remote location;
- Distance Learning, lecture from a remote site very near to particular objects (monuments);
- Dynamic guide, download on his own PDA or laptop the guide of the museum or info concerning particular objects while visiting;
- Data transfer, concerning the set up of a virtual laboratory, virtual museum, virtual landscape, virtual excavation, the transfer of pictures and movies;
- Real time transfer of data acquired from airplanes or helicopters;
- Remote control and monitoring of museums or sites of particular interest;

Cultural Heritage Scenarios



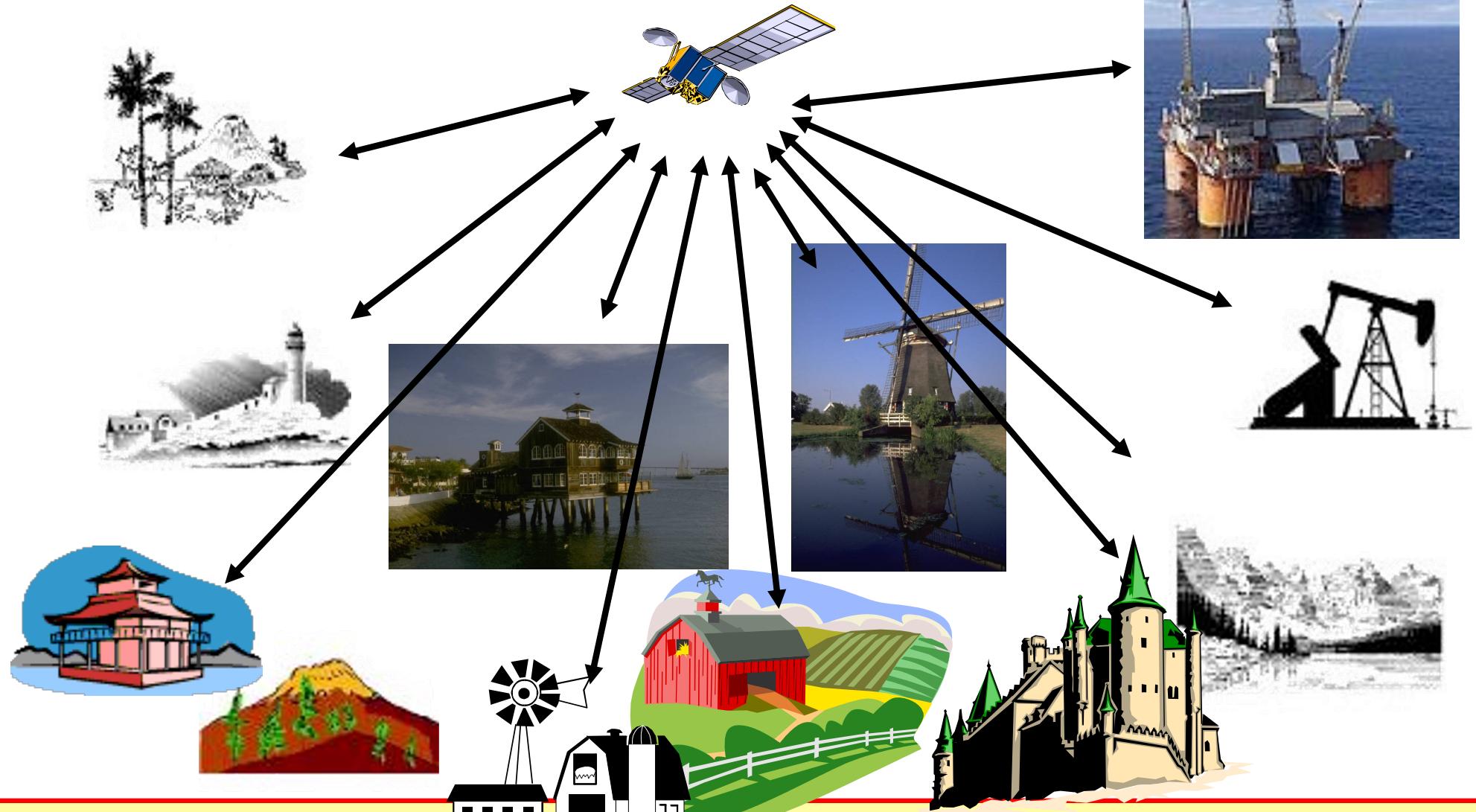
Multicasting/Multiconference

- Cost effective for multi party links
- Video conference with multiple sites
- Simultaneous file and data exchange

Remote location connectivity

- Scarce infrastructures compensation
- Digital divide
- Rural and impervious location access
- Environment monitoring
- Remote GSM/UMTS/WiFi coverage

Digital divide and Remote location connectivity



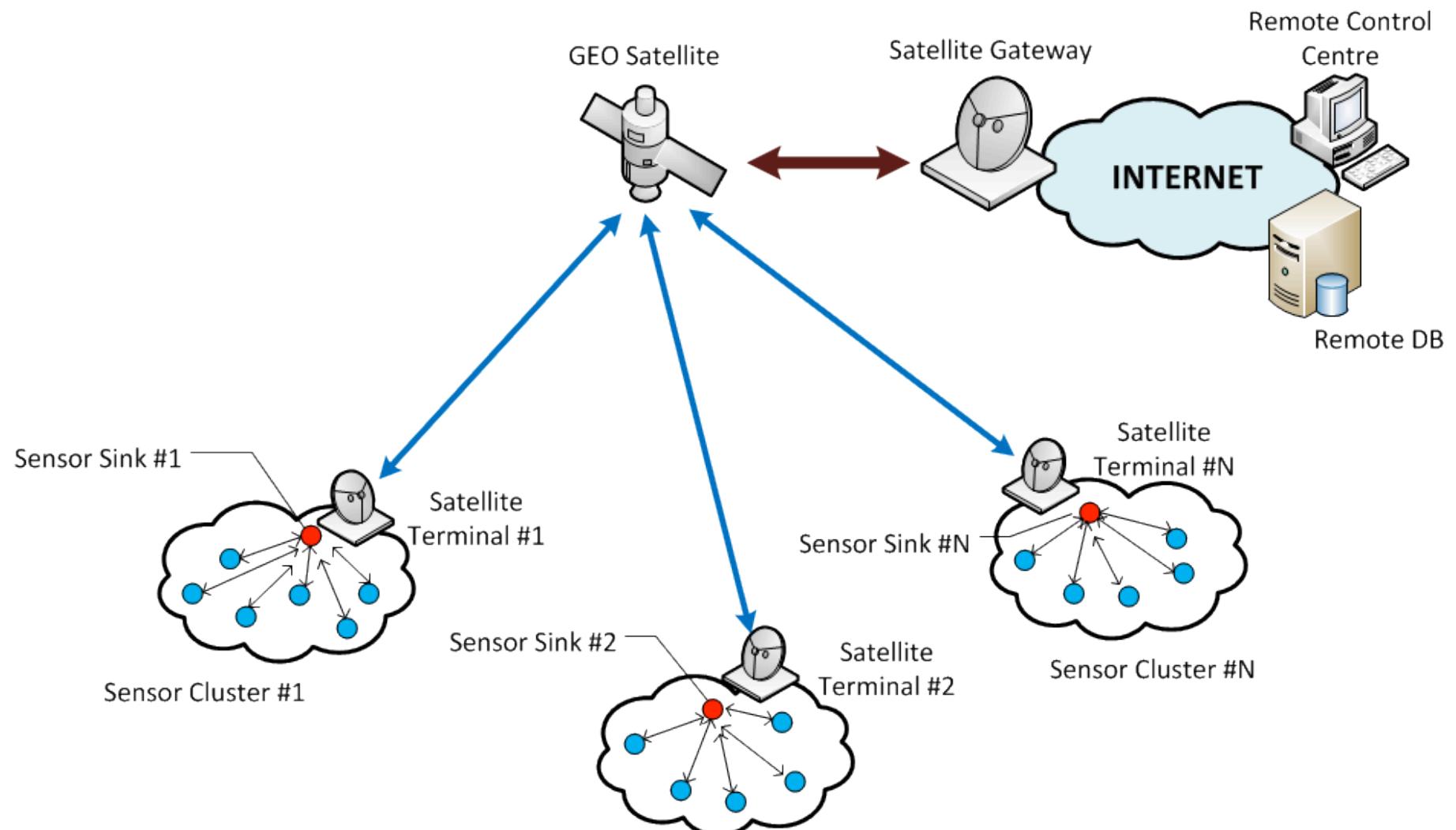
Tourism and entertainment

- On demand movie distribution for hotels, airplanes, ships
- TV distribution for hotels, airplanes, ships
- Cellular systems remote location (GSM, UMTS) on ships and airplanes
- High data rate while moving

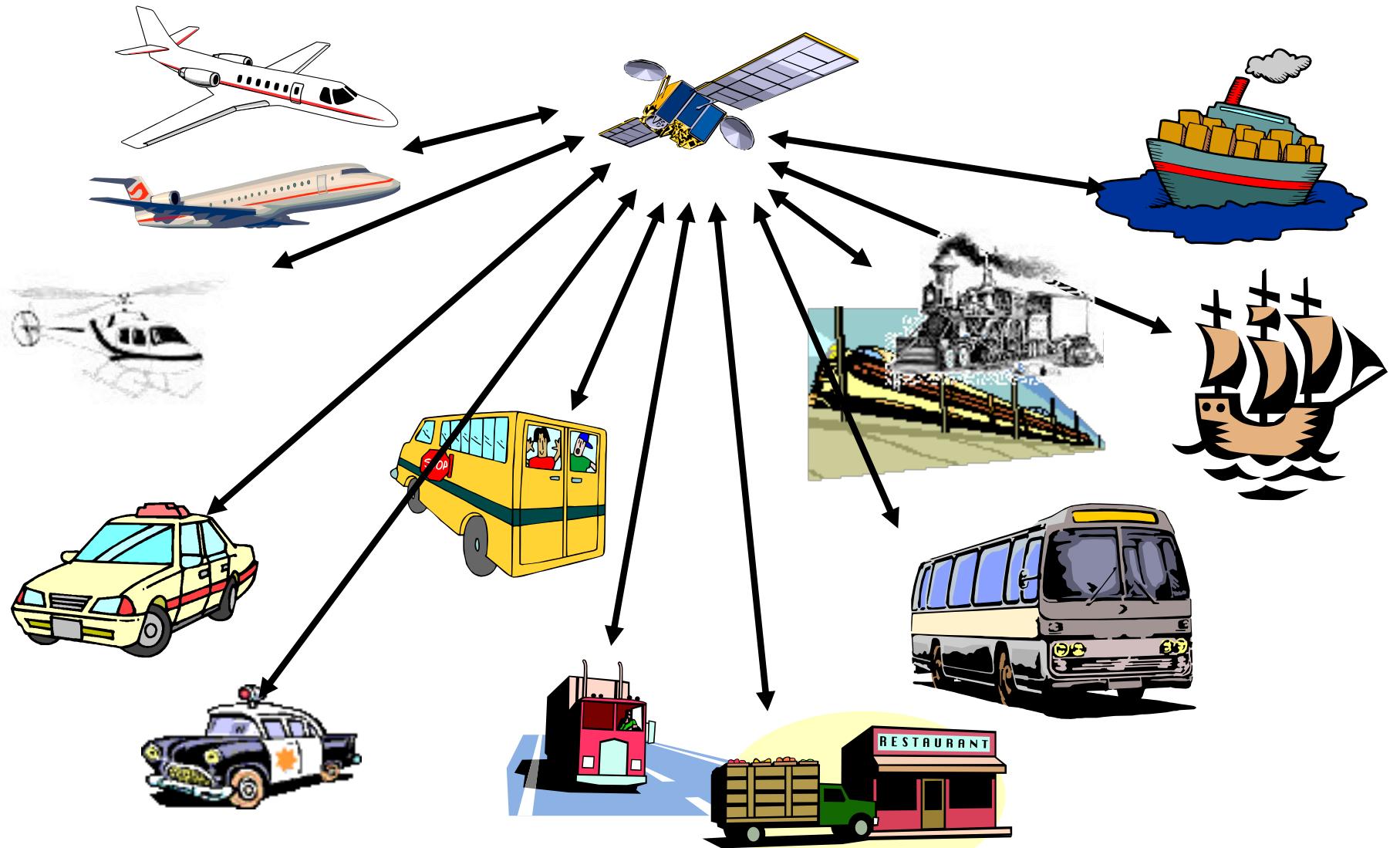
Long range mobility

- Applicability
 - Airplanes, Ships (Cruise, Cargo), Trains, Trucks, Buses, Helicopters
- Applications
 - Remote GSM/UMTS/WiFi coverage
 - Banking, weather forecast, entertainment (movies on demand)
 - Route control, remote check of vehicle and status of cargo
 - Fleet management

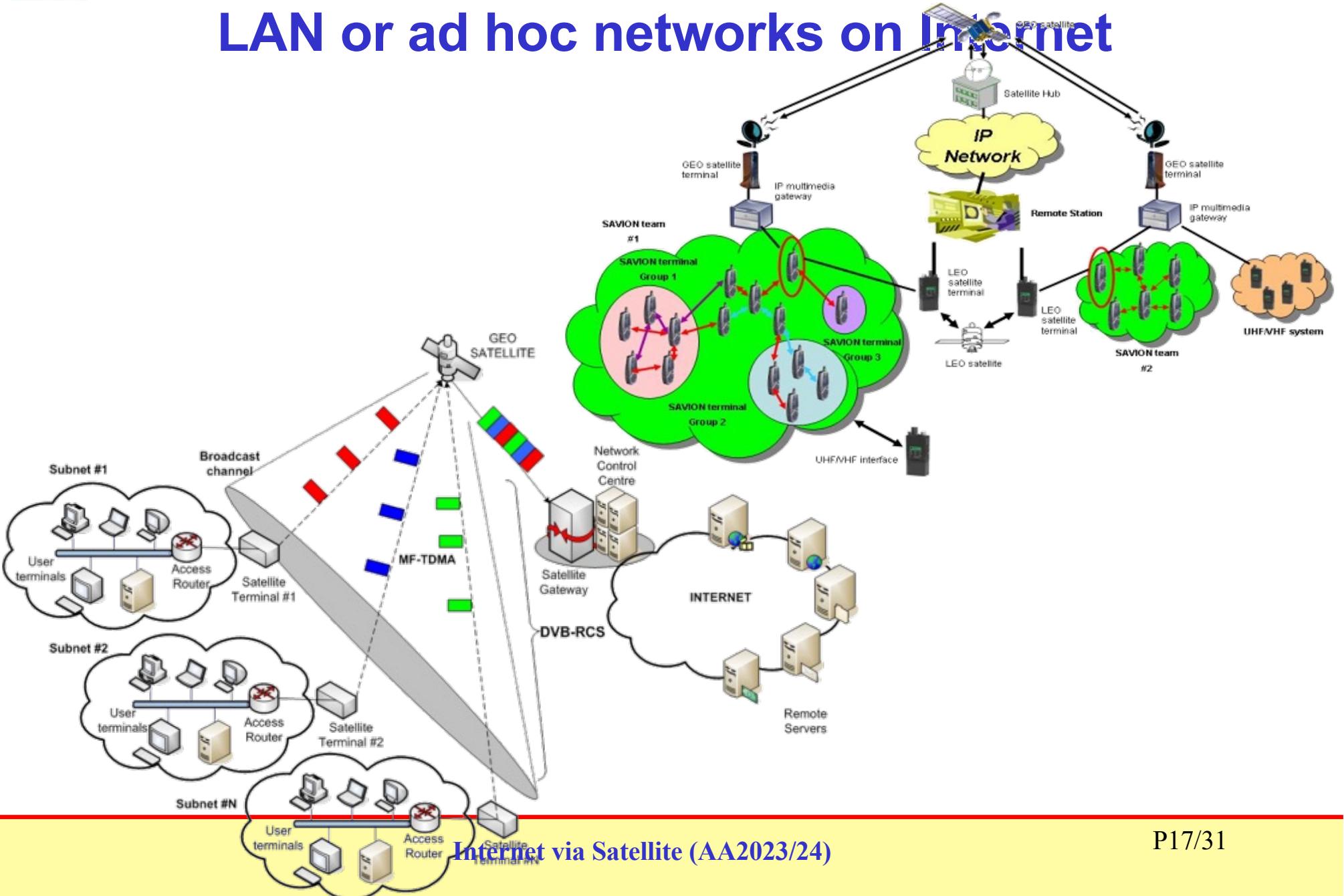
Sensor networks for environmental and critical infrastructures monitoring



Vehicular communications



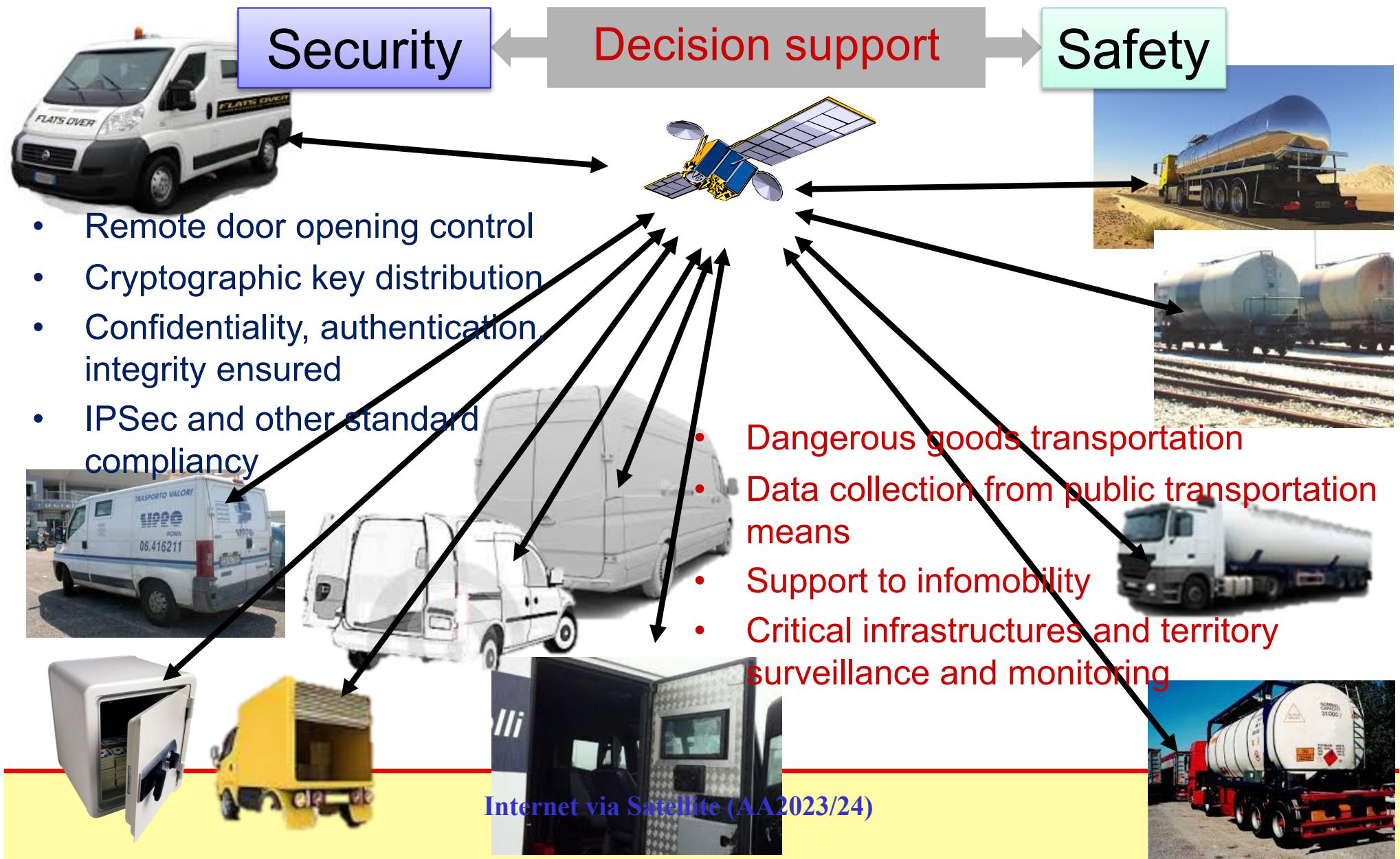
LAN or ad hoc networks on Internet



Energy and smart grid



Security & Safety services



Location based services

- Synergy with localization systems (GPS/Galileo)
- Local advertisement distribution
- On demand tourist info delivery

Bypass congested terrestrial networks

- Typical internet connection 17-20 nodes estimated
- With one hop very long distances reached
- Propagation delay compensated by queuing time in congested routers

Secure services

- Remote door opening control
- Cryptographic key distribution
- Decision support
- Confidentiality, authentication, integrity ensured
- IPSec and other standard compliancy