

cell & sat



*Cellular and Satellite:
together to serve a fast
growing market*

Didier Verhulst

Presentation at COMSYS VSAT 2009

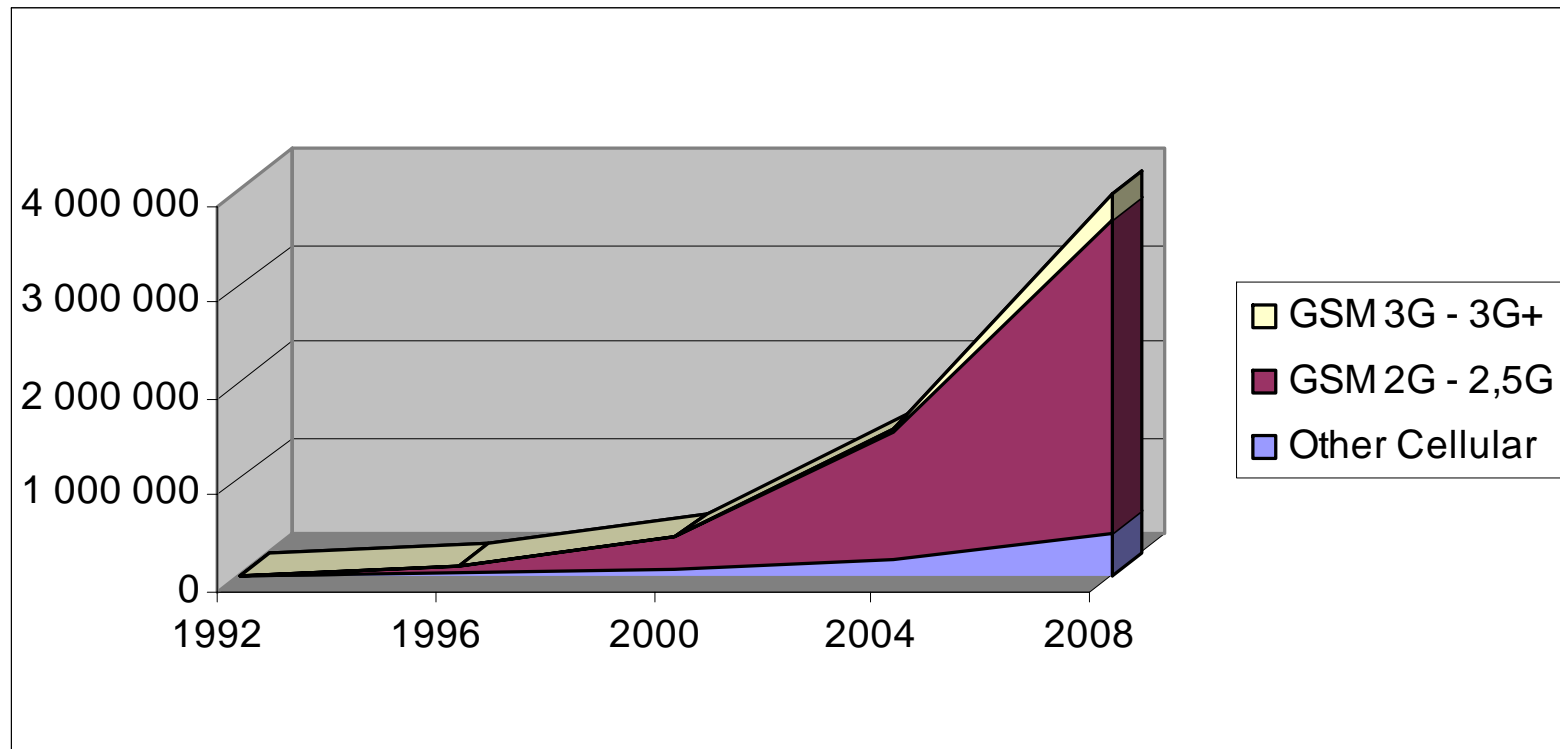
London, 18th September 2009

How to get the best from cellular and satellite technologies together ?



Cellular growth worldwide (1/2)

➤ Today more than 4 Billions cellular users in the world



.... and only about 1,6 Billions Internet users !

Cellular growth worldwide (2/2)

➤ But still many areas uncovered

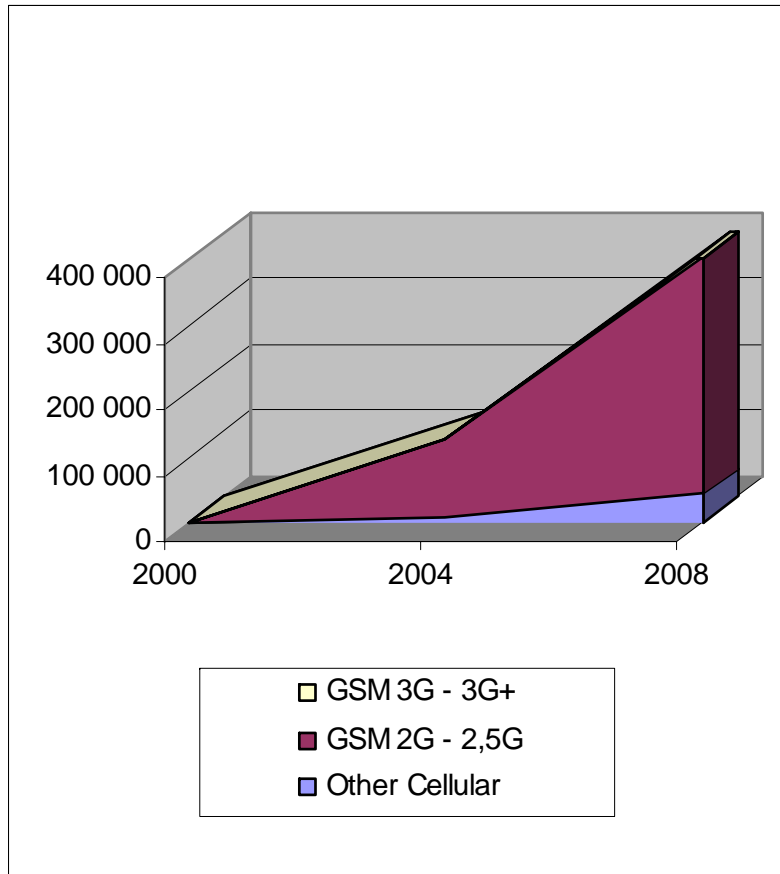


2G 3G

Source GSM Association, beg. 2009

Cellular growth in Africa

➤ Today 400 Millions cellular subs in Africa, growing fast



Source GSM Association, beg. 2009

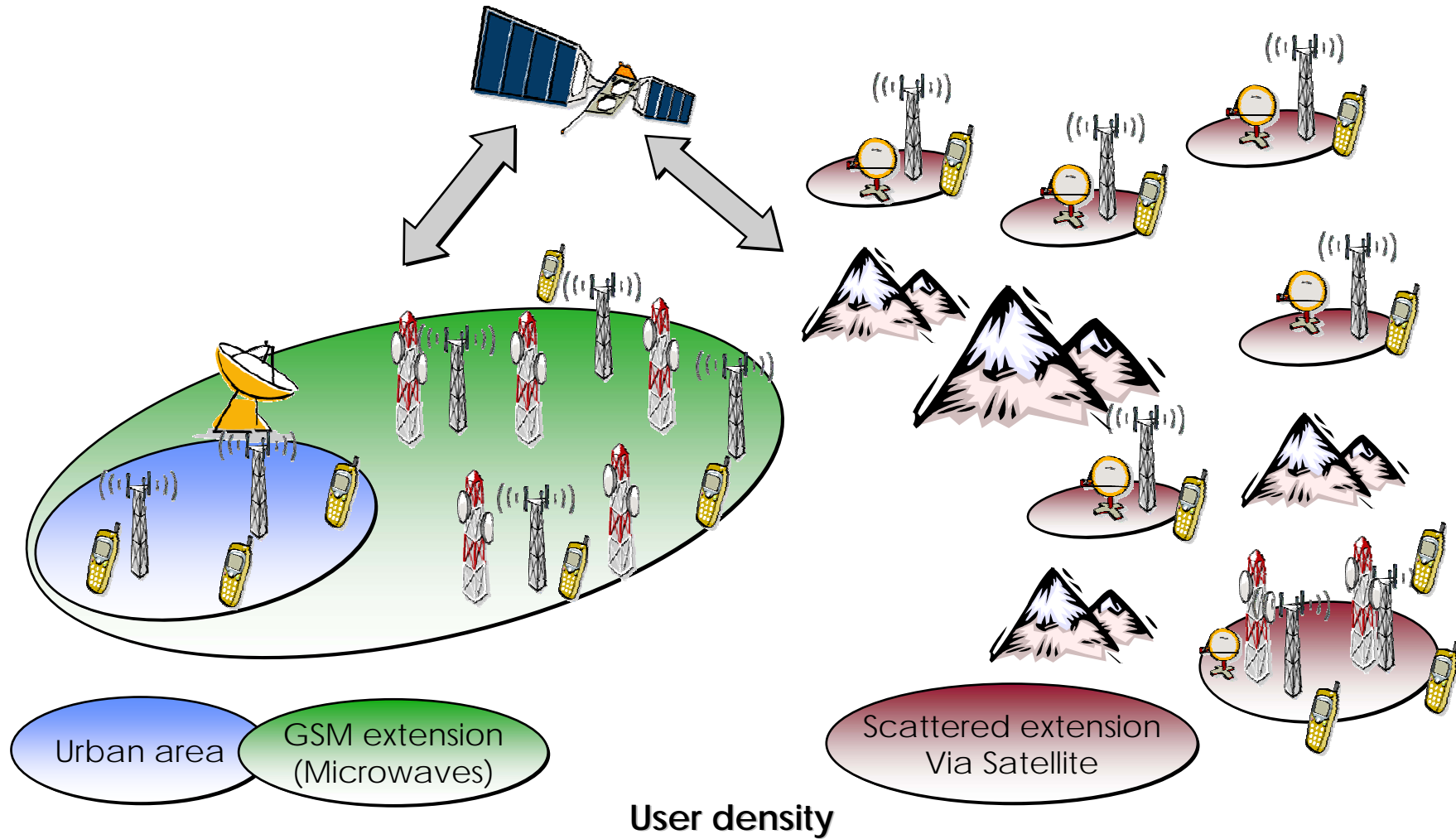
... but still a lot to do: only about 70 % population & 20% area covered

Looking for low cost cellular coverage

- **A challenge for mobile operators is to serve remote rural villages with low income subscribers**
 - Monthly Average Revenue Per User (ARPU) less than \$10 in villages
- **It is therefore essential to reduce CAPEX as well as OPEX**
 - Both for cellular and for transmission equipment



Satellite is often the only available transmission solution



But satellite transmission is considered costly !

- **Today: satellite links are mainly used to connect remote but large cities**
 - Using dedicated satellite resource and SCPC modems
 - Often without the most advanced optimization
 - Satellite being perceived as a mandatory but expensive solution waiting for a terrestrial transmission replacement (microwave, fiber)
- **Satellite backhaul in Africa is still constrained by the lack of satellites coverage**
 - The cost of leasing transponders remains very high
- **There is therefore a growing demand for optimized satellite cellular backhaul solutions !**

Ongoing progress in satellite backhaul transmission

➤ Optimization of satellite modems

- High density modulation
- Link adaptive coding, Carrier-in-carrier channeling
- C band, but also Ku and soon Ka band as well

➤ GSM interface compressors

- Taking advantage of silence in speech, signaling and data to reduce throughput

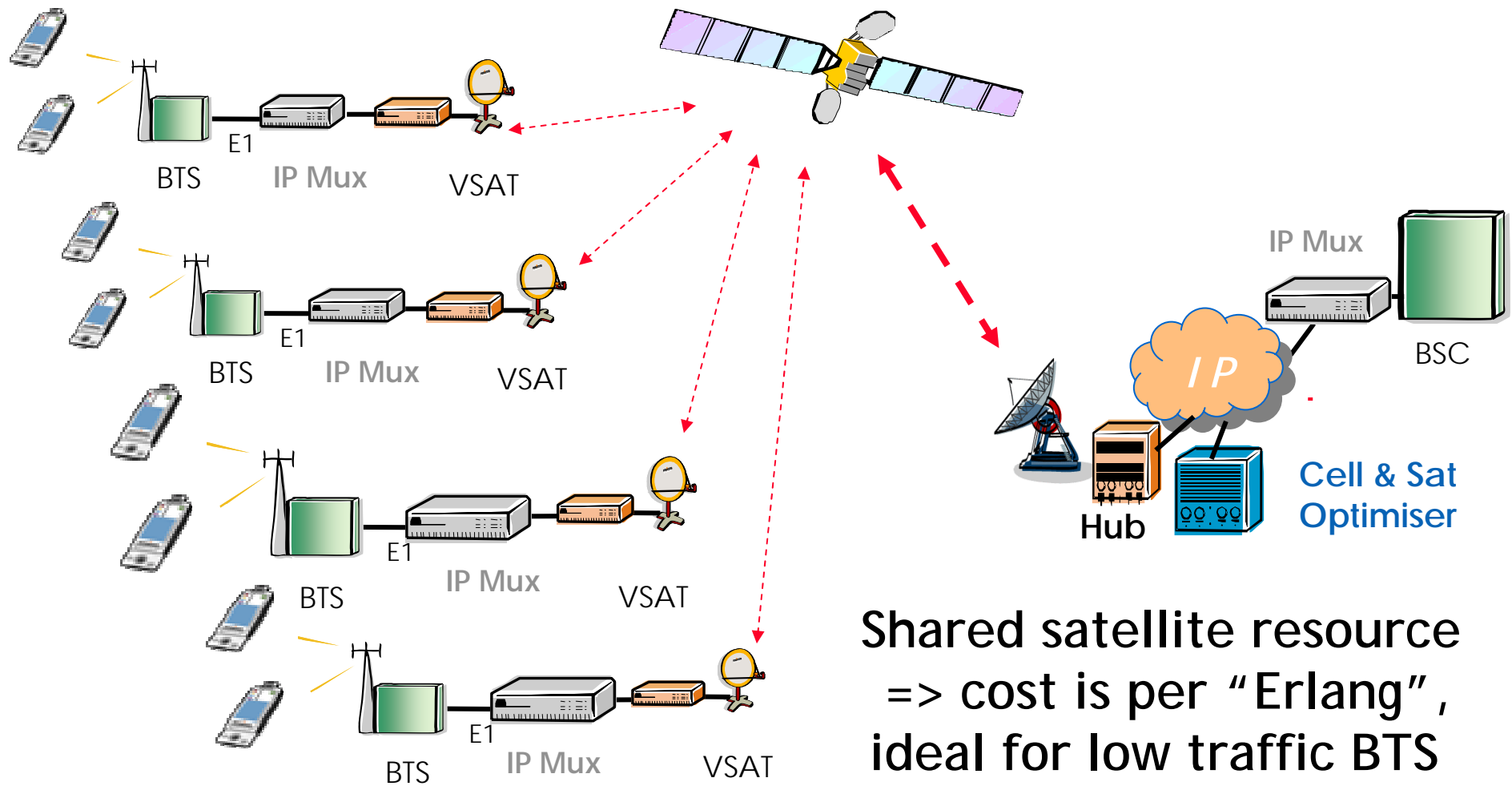
➤ Dedicated and shared resources

- Shared forward link: e.g. DVB-S2 with TDM
- Demand Assigned Multiple Access for return links

➤ Star, meshed, or mixed star - meshed configurations

➤ New broadband IP VSAT technologies

GSM backhaul over broadband IP VSAT



Shared satellite resource
=> cost is per "Erlang",
ideal for low traffic BTS

New GSM solutions for rural

➤ Low CAPEX BTS equipment

- More and more software than hardware based
- With a strong competition between vendors !

➤ Main costs are today in shelters, site installation, antennas

- New "all-in-one" compact rural GSM base stations are proposed
- With high power / sensitivity BTS to reduce antenna mast height:
 - from 30 m down to 15 pm or less

➤ OPEX savings

- Migration from TDM towards IP based links
- Outside the electricity grid: energy based on solar cells rather than fuel
- Optimization functions: BTS concentrators, local switching, energy saving features (idle mode), etc

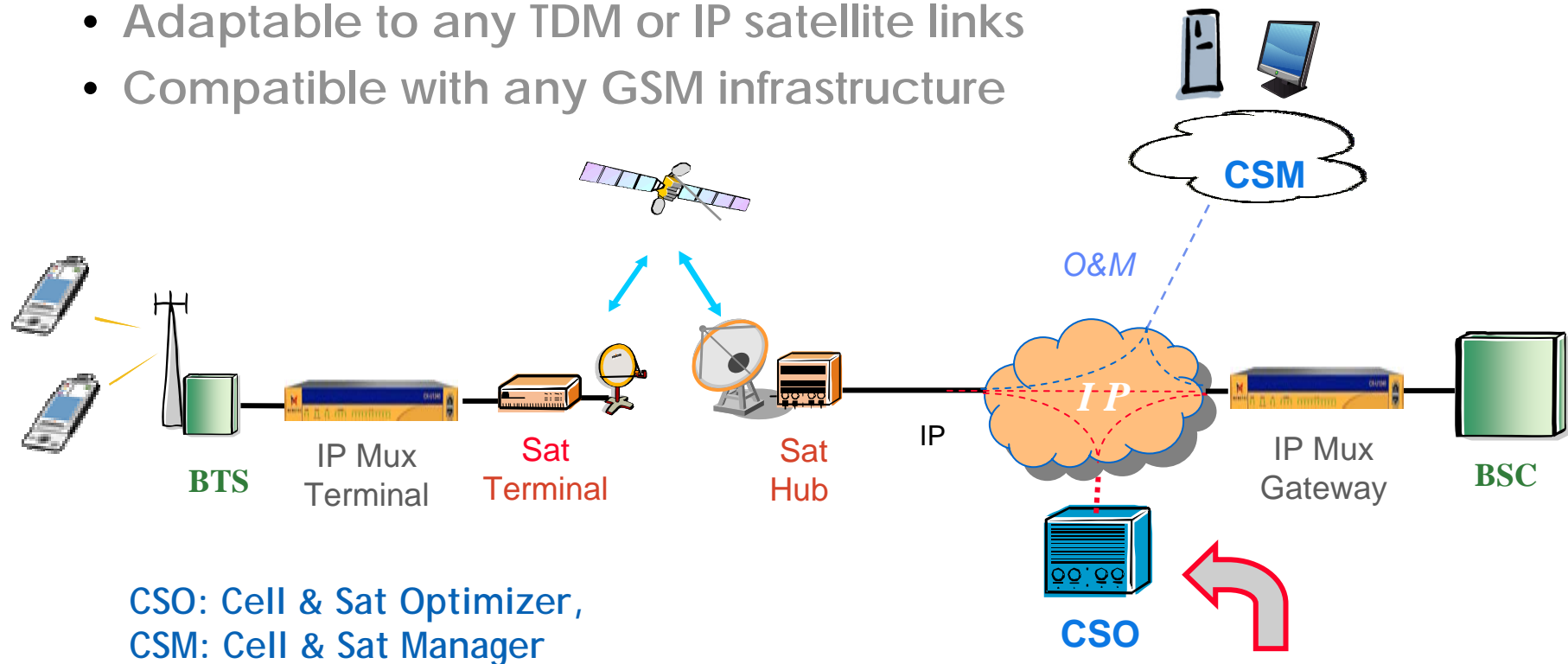
New solutions for satellite GSM backhaul (1/2)

- **The GSM system includes functionalities to utilize its cellular radio frequencies very efficiently**
 - Adapting to fast variations of the radio links
 - Managing mobility of users
 - Controlling evolution of overall traffic
 - Optimizing various types of services: speech, messaging, high speed data, etc
- **Interpreting the GSM signaling is a very powerful tool to optimize the satellite radio frequencies as well !**
 - Traditional GSM backhaul provides a transparent pipe to transport GSM traffic data and signaling
 - Optimized backhaul can provide the minimum satellite resource required for the actual GSM traffic

New solutions for satellite GSM backhaul (2/2)

➤ Optimized cellular backhaul

- Developed by Cell & Sat in partnership with Memotec
- Adaptable to any TDM or IP satellite links
- Compatible with any GSM infrastructure



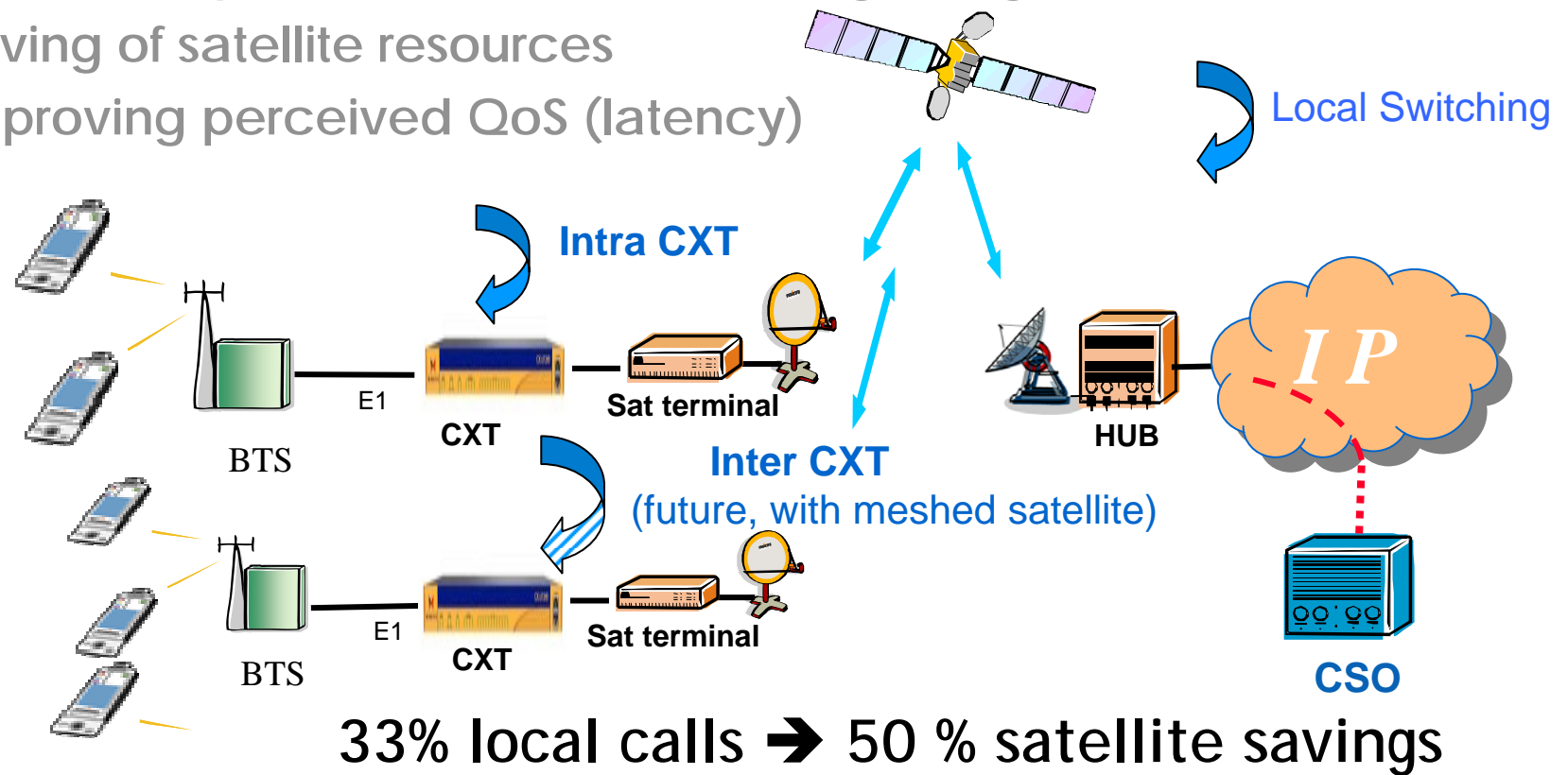
CSO: Cell & Sat Optimizer,
CSM: Cell & Sat Manager

GSM signaling analysis, backhaul optimization

Key features (1/2)

➤ Optimized routing of speech

- Local switching of speech information whenever possible
- 100 % transparent to GSM control & signaling
- Saving of satellite resources
- Improving perceived QoS (latency)



Key features (2/2)

➤ Control of satellite resources allocation

- Information on GSM calls used to optimize satellite resources allocation
 - With an interface between the CSO and Satellite resource controller
- Optimum loading of shared (DAMA) satellite frequencies
 - Avoiding degradation of GSM calls under satellite congestion

➤ Adaptation to new cellular architectures

- Same principles can be applied to new IP based cellular networks
 - No more requirement for TDM - IP multiplexers
 - But adaptation needed to specific IP based BTS – BSC interface
- This backhaul architecture valid also for broadband cellular
 - Migration from GSM 2G to 3G, 3G+

➤ Optimized integrated rural “cellular +satellite” solution

- Developed in partnership with cellular and satellite vendors

Status

➤ Local Switching function

- Fully integrated with Memotec CX product
- Extensive validation performed with a major GSM vendor
 - Without any adaptation to existing cellular equipment
 - Compatible with all services as well as legal interception



➤ Pilot networks in 2009

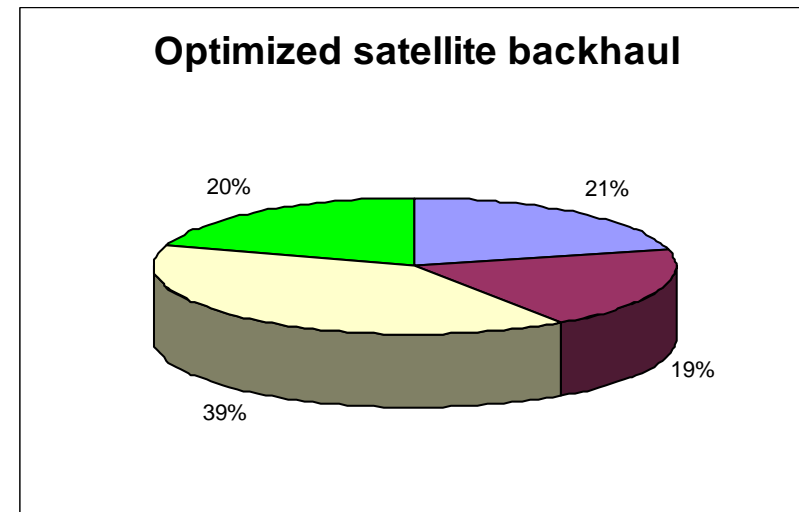
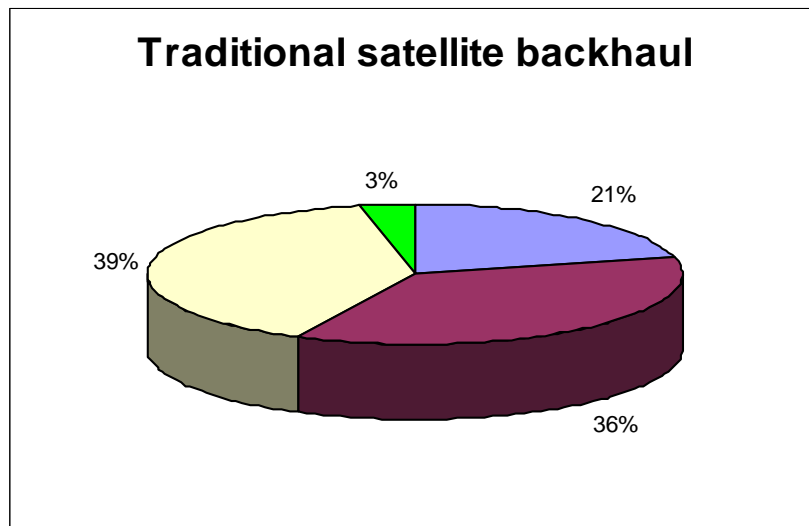
- With GSM network equipment from several vendors
- To optimize existing satellite backhaul
- Or to provide GSM coverage in new rural areas

➤ Ongoing development of the Cell & Sat solution

- New functions taking benefit of the cellular signaling analysis
- Adaptation to IP based cellular architectures

Business benefits

- Cell & Sat performed detailed business evaluations of the rural GSM potential in developing countries
 - Case studies in various African countries (consultancy work)
 - Business planning for satellite operator and cellular operator
 - Typical GSM operator profitability example below (with ARPU= \$9)



■ Network costs ■ Transmission costs ■ Other operator costs ■ Margin

Our vision

Cellular and Satellite operators - manufacturers
working together to reach new horizons



www.cell-sat.com