

Satellite-Delivered Universal
Personal Communications:
Market Development,
Technological and
Regulatory Issues

by Rob Frieden

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**SATELLITE-DELIVERED UNIVERSAL PERSONAL
COMMUNICATIONS:
MARKET DEVELOPMENT, TECHNOLOGICAL AND REGULATORY
ISSUES**

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I. Overview of UPC

A. Definition: UPC expands and extends the concept and market penetration of predominately mobile telecommunications to make it interpersonal, ubiquitous, provided by tetherless technologies, and initially linked with existing "wireline" networks.

1. **Interpersonal**--it expands the scope of available options to users thereby enhancing productivity, convenience and effectiveness; where no network exists, it provides a more quickly deployed infrastructure.
2. **Ubiquitous**--initially, it will extend and augment the services of incumbent, primarily wireline carriers; over time it will become more diversified and affordable resulting in a growing percentage of traffic carried exclusively on "wireless" networks.
3. **Tetherless**--users of mobile services do not seek complete separation from existing networks, and in fact require access to the predominantly wireline public switched network of today.
4. **Linked with existing networks**--for the majority of applications and traffic volume, users of tetherless communications need wireline access for the "first" or "last" mile. UPC initially will augment wireline traffic flows and because of its subordinate status, will pay for access. In the future, it increasingly will "by-pass" the services and facilities of incumbents. Also, it will so stimulate demand for access from wireline users that its operators will become correspondents with, rather than customers of incumbent wireline carriers.

B. Macro-Level Issues

1. **Market Demographics**--population density, distribution, income, service demand.

- a. What is the target market? consider a continuum with niche markets and selective coverage at one pole and radio-based substitutes for basic wireline exchanges at the other pole.
 - b. Is the market self-contained, or part of a larger network achieved through interconnection and roaming agreements, e.g., dual mode LEO/cellular hand sets.
2. **User Mobility**--fixed ("wireless local loop"), mobile, maritime, aeronautical, land.
- a. Densely populated urban centers will have diverse and quickly deployed service; other areas require large cells and an attractive per subscriber cost to available wireline options.
 - b. Rural locales, especially ones with rugged terrain, will enjoy more diverse radio-based options, particularly if governments mandate cross-subsidies.
 - c. Developing nations provide an attractive market for unsubsidized, overlay urban networks and subsidized, first service in the hinterland.
3. **Spectrum Access**--ITU/domestic allocation, allotment, assignment, licensing (auction, comparative hearing, lottery, franchise, "reserved" service); interference potential. Companies with "deep pockets" bid \$7.7 billion for the opportunity to provide wideband, terrestrial PCS in 51 Major Trading Areas.

4. **Technology**-- (LEO, ICO, MEO, GSO, Brilliant Pebbles/Brilliant Eyes); transmission formats (SCPC, TASI, TDMA, CDMA)
 - a. Orbital Types
 - (1) Little LEOs-- narrowband data, position location, paging and messaging applications.
 - (2) Big LEOs--slow speed (4.8 kbps) voice, data, fax, data and position location applications.
 - (3) Geostationary, Middle Earth Orbiting, or Intermediate Circular Orbiting--slow speed (4.8 kbps) voice, data, fax, data and position location applications.
 - (4) "Star Wars"--840 refrigerator-sized satellites provide a global, broadband grid primarily from fixed, or quasi-fixed locations.
5. **Integration**--will UPC easily fit into the mix of existing services, constitute a threat to incumbents or both?

- a. Bypass or alternative?--will UPC so migrate traffic and revenues from incumbents as to "strand" investment resulting in the need to raise POTS rates? what traffic and revenue stream entitlements do incumbents have?
 - b. Will incumbents find a way to co-opt the competition?
6. **Geographical Coverage**--pico, micro, conventional cellular size local service, regional, national, or international; note that satellite-delivered service involves quite large cells, e.g., 59 Iridium cells for all of CONUS; new terrestrial options will cover a few city blocks.
- a. Building out terrestrial service requires cost/revenue analysis on a cell by cell basis, but often regulations impose service availability throughout a region. Satellite service typically involves regional, or global coverage on an "all or nothing" basis.
 - b. Evolving wireless technologies provide the basis for realization of Professor Nicholas Negroponte's view that much of the traffic traversing wireline facilities could more efficiently use wireless applications and vice versa; this assumes that wireless applications will become ubiquitous.

- c. Mobile users crave any time, anywhere service using one personal identity code via lightweight, handheld terminals, i.e., Dick Tracy's wristwatch radio. How much are they willing to pay for such convenience?
7. **Scope of Regulation**--treat UPC as a minor adjunct of conventional service qualifying for private carrier status, or consider the potential for market power and assert common carrier regulation; important factors: number of carriers, potential for competition, need to guard against anticompetitive practices, e.g., cross-subsidization, predatory pricing, monopolization, discriminatory access to the wireline PSTN, etc.
- a. Private, non-common carriers have no market power, provide non-essential service, can discriminate on price and availability, and enjoy limited regulation to promote innovation and nimbleness.
 - b. Common carriers may have market power, typically provide essential services, may initially have received an exclusive service franchise, cannot discriminate, must provide service to all users and face substantial regulation to safeguard the public interest re. market entry and exit, rates and tariff terms and conditions.
8. **Cost of Service**--a business tool for elites, technicians, and frequently mobile professionals, e.g., real estate agents or as common as pay phones? flat or usage sensitive pricing; if metered, what kind of rates and what services provide competition?--a "functional equivalency" evaluation.

- a. Mobile terrestrial systems have developed different pricing points and rate plans to attract different user population levels; as networks and markets mature, user populations grow, but the per minute of use rate and the aggregate minutes of use per subscriber drops.
 - b. Mobile users will pay a premium for service, but when UPC provides near functional equivalency to pay phones or other non-metered applications consumers resist metering and premium rates. Would you pay \$14.95 a month plus \$0.25 per MOU for the opportunity to make, but not receive calls using a handset, lighter than some cellular phones with a longer battery life? On the other hand, would you pay \$3-5 per minute for reliable satellite service in lieu of unreliable \$10-30 per minute service from a hotel switchboard in Moscow, Lagos and elsewhere?
9. **Reliability**--quality of service and call blocking at local exchange or cellular carrier levels?
- a. Cellular radio and CATV operators benefit from lower consumer expectation of service quality, reliability and response times to outages; but when these and other operators provide essential first and last mile functions, they have to operate with 99.999+% reliability. What kind of in-building signal penetration, if any, can we expect from satellite UPC?

10. **Throughput**--narrowband, slow speed data applications, voice, or broadband?
 - a. Service versatility and the scope of competition largely depends on the amount of spectrum allocated; as newcomers, UPC operators had to convince ITU delegates and national regulators to re-allocate spectrum, often forcing incumbent users to share or to relocate.
 - b. UPC operators may clear spectrum by paying incumbents to move.
11. **Standards**--need for common air interfaces, connectivity between networks, seamless interconnection with incumbent (wireline) facilities, "number portability," and "follow me" roaming.
12. **Revenue Division Between Networks**--wireline networks are now recipients of access payments, but never payers; a correspondent relationship would require settlement of accounts as is done in cellular radio roaming and in carrier-to-carrier interconnections. Simply allowing call originations might qualify an uninvolved PTT for a "piece of the action."

II. **Is Satellite-delivered UPC Universal, or Limited to Market Niches?**

A. Preliminary Market Segments

1. Business executives, particularly ones with the desire to have one transceiver operable anytime anywhere ("road warriors")
2. Government, especially for disaster recovery, emergency and tactical communications.
3. Industrial, e.g., oil exploration in remote regions.
4. Coastal maritime, outside cellular and VHF range.

5. Aeronautical.
6. High income, particularly for time sensitive calling.
7. Rural, particularly if subsidized.

III. **Lessons and Future Trends**

- A. Tetherlessness is a goal, not a reality.
 1. Wireless systems will challenge the incumbent, local exchange common carrier model and the view that the local loop is a natural monopoly.
 2. But UPC will evolve from many of the current services and models that track marketing, regulation, policy, spectrum allocation, standard setting, etc.
 3. Most incumbents will survive, if not thrive, provided they accommodate new technologies and players, rather than attempt to perpetuate the status quo.
 4. Greater attention is needed on matters affecting user convenience and service as opposed to technology for the sake of innovation.
 5. The Ramp up of cellular radio attests to the value of mobile services and reliable switched public service: 0 to 30 million in 10 years.
 - a. Cellular as an overlay network in areas with unreliable service.
 - b. Cellular in lieu of wireline facilities.
 - c. Cellular as a productivity enhancement tool for mobile societies.

6. Despite unprecedented success in technological diffusion, cellular penetration rates are at best 3-7 subscribers per 100 inhabitants.
7. Wireless-wireline network interconnection terms and conditions will shift from wireless operators as access consumers to correspondents and equals in the toll revenue division, settlements process.
8. Satellites will play a gap filler role that can be profitable and essential.

IV. Unresolved Questions and Challenges to Satellite UPC

- A. Will incumbents embrace the technology and the services? If yes, which ownership model will they apply:
 1. The traditional submarine cable (TAT-x, TPC-x)/satellite (Intelsat, Inmarsat, Eutelsat) consortium model;
 2. The developing strategic alliance model, e.g., Worldpartners, Eunetcom, Unisource, BT-MCI; FT-DT-Sprint;
 3. The developing terrestrial mobile services model where incumbents and newcomers establish new alliances, e.g., Deutsche Telekom-Mannesmann-Pacific Telesis (cellular radio in Germany); Westel Raditefon, Kft., a joint venture of U.S. West and the Hungarian Telecommunications Co. (cellular radio in Hungary).
 4. Most incumbents have allied with the Inmarsat P-21 "affiliate," but the hybrid incumbent/newcomer alliances of Iridium, Globalstar and Odyssey are formidable.
- B. Will there be millions of users willing to pay several dollars a minute? How many "road warriors" and other users have such inelastic demand that price is no concern?
- C. What revenue division arrangements and record accounting can satisfy all players (active and passive) in a cross-border routing scenario? The case of the road warrior from Japan who initiates a call in Nigeria destined for Pakistan and routed via a Hong Kong gateway.
- D. How many systems can operate successfully? The imperatives of link budgets, spectrum sharing, transmission formats, access to capital, and market depth.