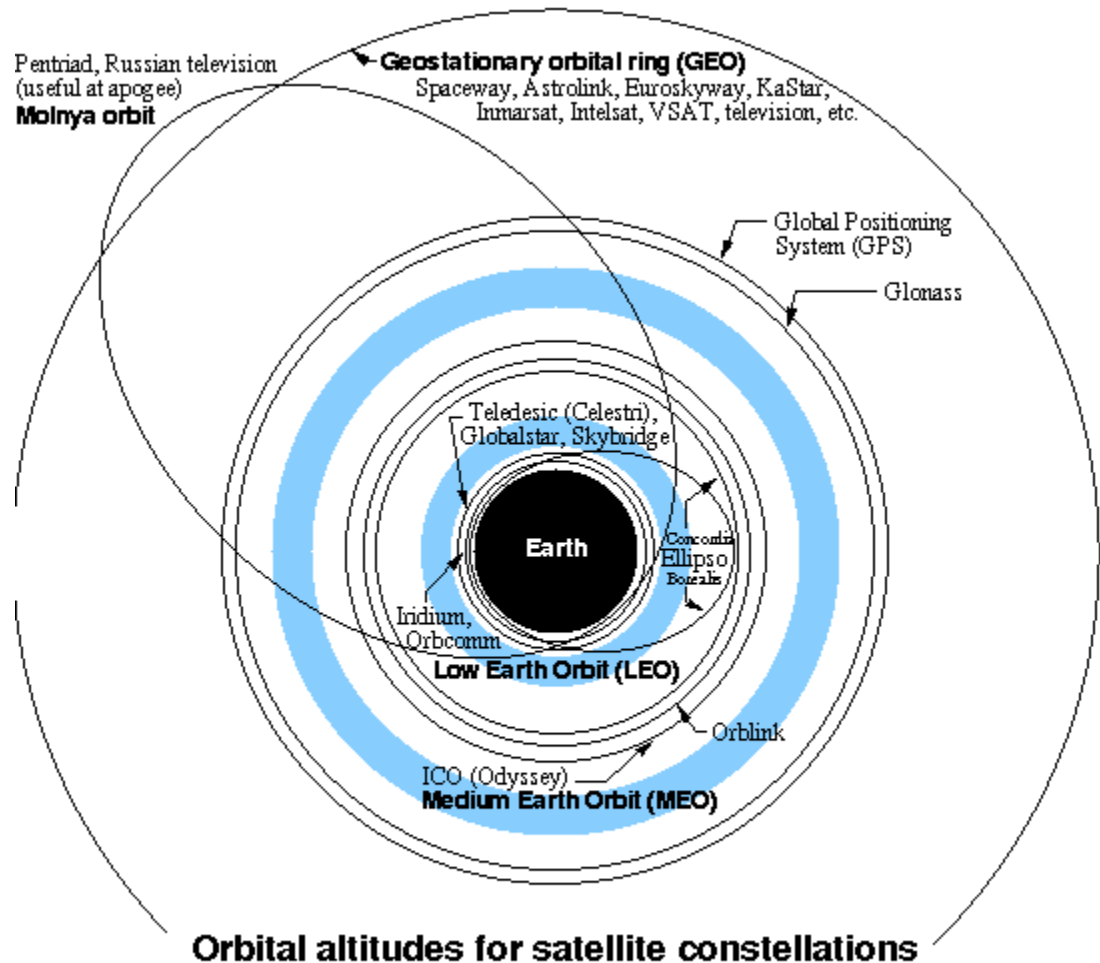


Rural Telecommunications (7) Access Technology III - Satellite Systems, Case Study I

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Satellite Orbits



■ peak radiation bands of the Van Allen belts (high-energy protons)

orbits are not shown at actual inclination; this is a guide to altitude only

from Lloyd's satellite constellations <http://www.ee.surrey.ac.uk/Personal/L.Wood/constellations/>

<http://www.ee.surrey.ac.uk/Personal/L.Wood/constellations/>

Satellite-based Systems

- Very small aperture terminals (VSATs)
- Lower earth orbit mobile communications
- Satellite-based Internet access

Very Small Aperture Terminals (VSATs)

- Antenna aperture diameter < a few meters
- Price US\$2000 – 8000

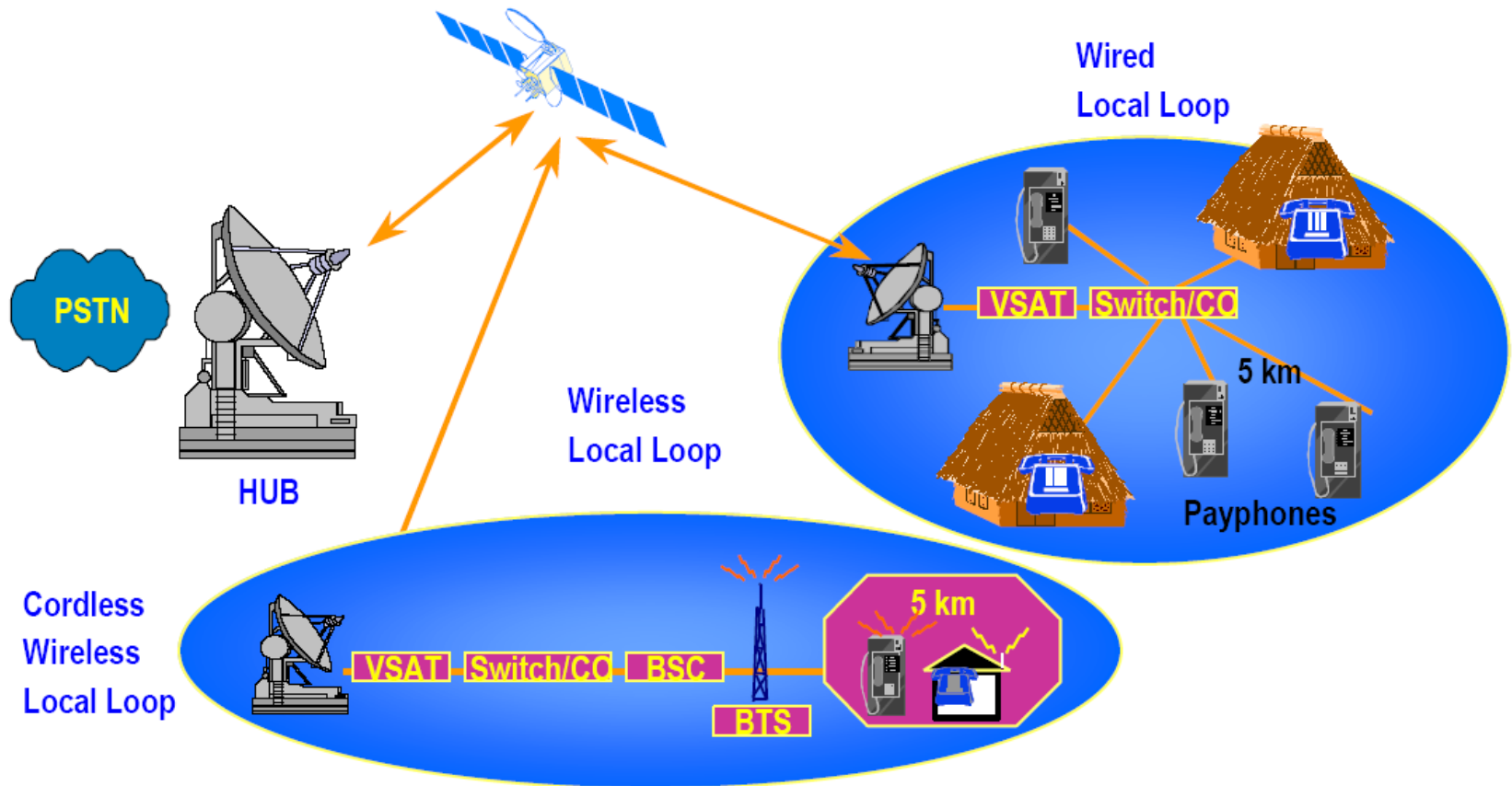


VSAT-based Rural Telephony

A case in Peru

- VSAT-based thin route telephony with up to three voice channels per VSAT
- Low power consumption of approximately 40 watts per VSAT
- Star network topology
 - 7.6 m Hub station in the capital city
 - 1.2 m or 1.8 m remote VSAT station in each town
- Prepaid system instead of coins
- Centralized network management system at Hub

2 - VSATs and Local Loops



BSC = Base Station Controller
BTS = Base Transceiver Station
CO = Central Office

Integrated VSAT/WLL Systems

A case of Intelsat

- VSATs with wired or cordless local loop systems are generally feasible for clusters of population requiring between 20 and 300 lines per site.
- VSAT plus macrocellular wireless local loop (up to 30 km radius) could be a feasible solution to serve medium density populations requiring more than 300 lines per site.

LEO Satellites: Iridium



66 satellites cover the whole earth



Handset terminal
375 g
Stand-by for 24 h
Call for 2.4 h

Iridium can be used in the middle of nowhere,
although expensive (\$6/min).



Satellite-based Internet Access

- 2-way Internet access via satellite
 - Very big cost – space segment
- No service available in Japan
 - SkyPerfecPC in failure
 - Uplink – telephone
 - Downlink – DBS satellite
- Service in Thailand
 - iPSTAR
- Trial in Japan again
 - Kizuna (WINDS)

In early deployment of broadband, traffic was modeled asymmetry.

IPSTAR-1

- World's first commercial IP satellite
- Shin Satellite Public Company (Thailand)
- Launched in August 2005
- Capacity of 45 Gbit/s
- Covers 4 continents
 - Asia, Europe, Australia and Africa.



Technologies of IPSTAR

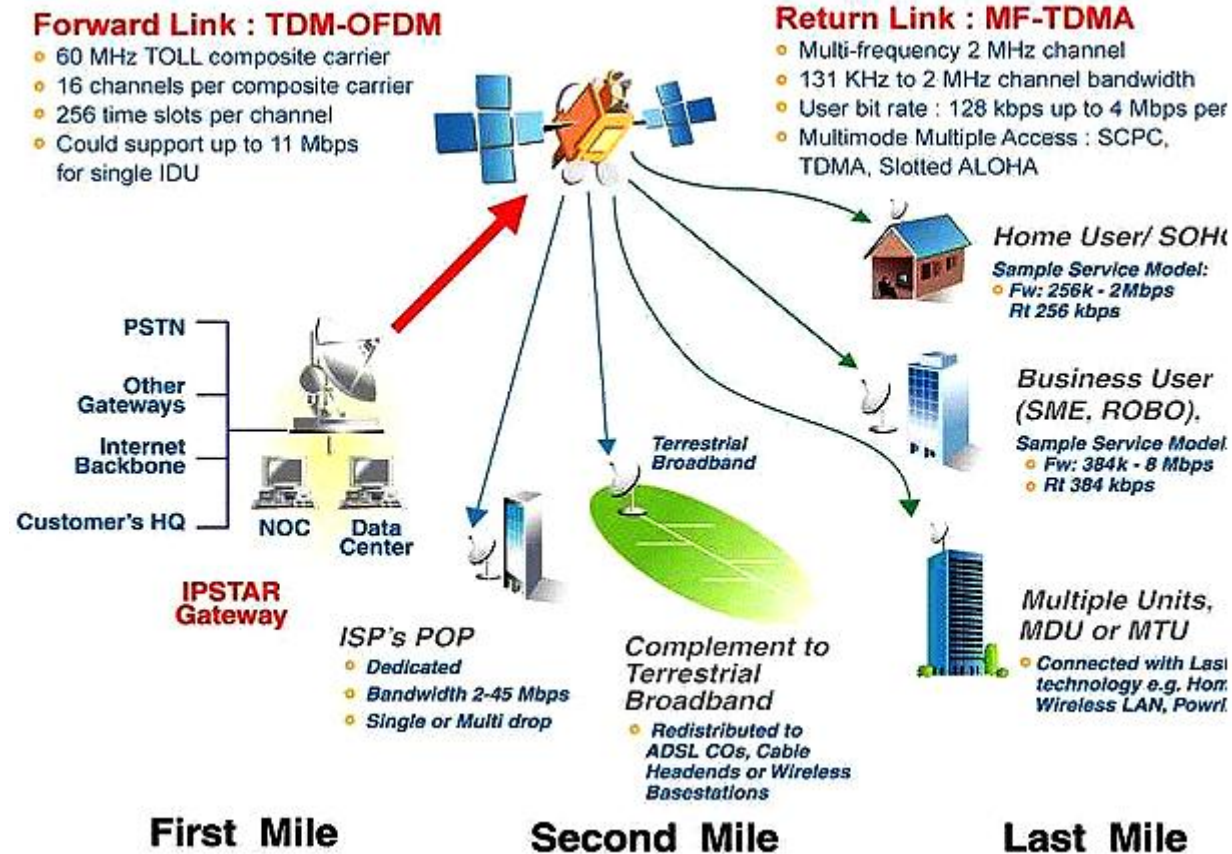
- CDMA
- Bent-pipe satellite
 - No advanced on-board equipments
- QoS (quality of services) support
 - Voice and off-line data have quite different requirements.
- Optional one-way connection using telephone line as the Return Link

Coverage of IPSTAR

- 22 countries throughout the Asia-Pacific Rim
- Spot beam and dynamic power allocation



Service Model of IPSTAR



Broadband Internet Access via IPSTAR

Dedicated Fixed Bandwidth

Class of Service			
Download Speed	128 kbps	256 kbps	512 kbps
Upload Speed	64 kbps	128 kbps	128 kbps
Sharing Ratio	1:1	1:1	1:1

Broadband Shared Bandwidth

Class of Service	Light	Medium	Heavy
Download Speed	256 kbps	1 Mbps	2 kbps
Upload Speed	128 kbps	256 kbps	512 kbps
Sharing Ratio	80:1	40:1	20:1

Computers in Public Basic Education Schools in Thailand ('05)

- No. of schools 32,413
- No. of students 8,638,000
- No. of Teachers 432,000
- No. of Computers 120,739
- Schools with Internet Access : all
 - Leased line: 1,000
 - Dial up :20,000
 - Satellite:11,000 (by iPSTAR)

Computers in Public Basic Education Schools in Thailand ('05)

Connection	Number of schools	Current speed	Target speed in '06
Dial up	20,000	56 kbit/s	ADSL
Leased line	1,000	128 kbit/s	1 Mbit/s
Satellite	11,000	56 kbit/s	512 kbit/s

Source: Ministry of Education, Thailand, Apr. 2006

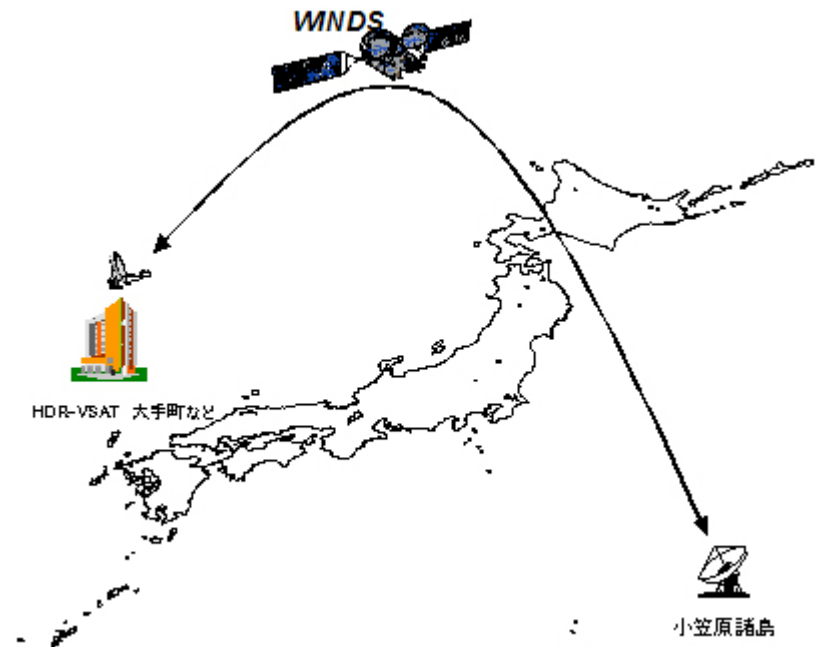
KIZUNA Internet Satellite

- National Internet satellite of Japan (JAXA and NICT)
- Launched on February 23, 2008
- 155Mbps (down) / 6Mbps (up) for households with 45 cm aperture antennas
- 1.2 Gbps for offices with 5 m antennas



KIZUNA Internet Satellite

- Establishing a domestic ultra high speed Internet network
- Constructing ultra high speed international Internet access, especially with Asian Pacific countries and regions
- Demonstration of validity and usefulness
 - Digital divide mitigation
 - Education
 - Medicine
 - Disaster measures
 - Intelligent Transport Systems



Pros and Cons of Satellite Links

Students' opinion/observation

Advantages

- Wide coverage area
- No wiring (compared with optical fiber)
- Mobility/portability of users
- Cheap initial cost
- Fast to deploy

Disadvantages

- Large delay between planning and deployment
- Expensive running cost
- Lifetime of satellites – 6-10 years
- High mobility can not be supported due to antenna pointing
- Smaller bandwidth than optical fiber

Prof. Muhammad Yunus & Grameen Bank Awarded The Nobel Peace Prize for 2006



- ... for their efforts to create economic and social development from below.
- Lasting peace can not be achieved unless large population groups find ways in which to break out of poverty.
- **Micro-credit** is one such means.
- Development from below also serves to advance democracy and human rights.

Grameen Telecom

The Village Phone Program

- Public telephones in rural areas of Bangladesh
 - 90% of 68,000 villages had no voice connectivity in 1999
- Developed by Grameen Bank (GB)
 - A world-famous microcredit facility that provides capital to the poor people of Bangladesh.
- Village-based micro-enterprises of privately operated phone centres
 - Targeting the installation of 40,000 village phones by 2002
 - Largest wireless payphone project in the world

Grameen Telecom

The Village Phone Program

Objectives

- To provide easy access to telephony when needed, all over rural Bangladesh
- To introduce a new source of income generation for villagers
- To bring the potential of the Information Revolution to the doorstep of the villagers
- To introduce telecommunications as a new weapon against poverty

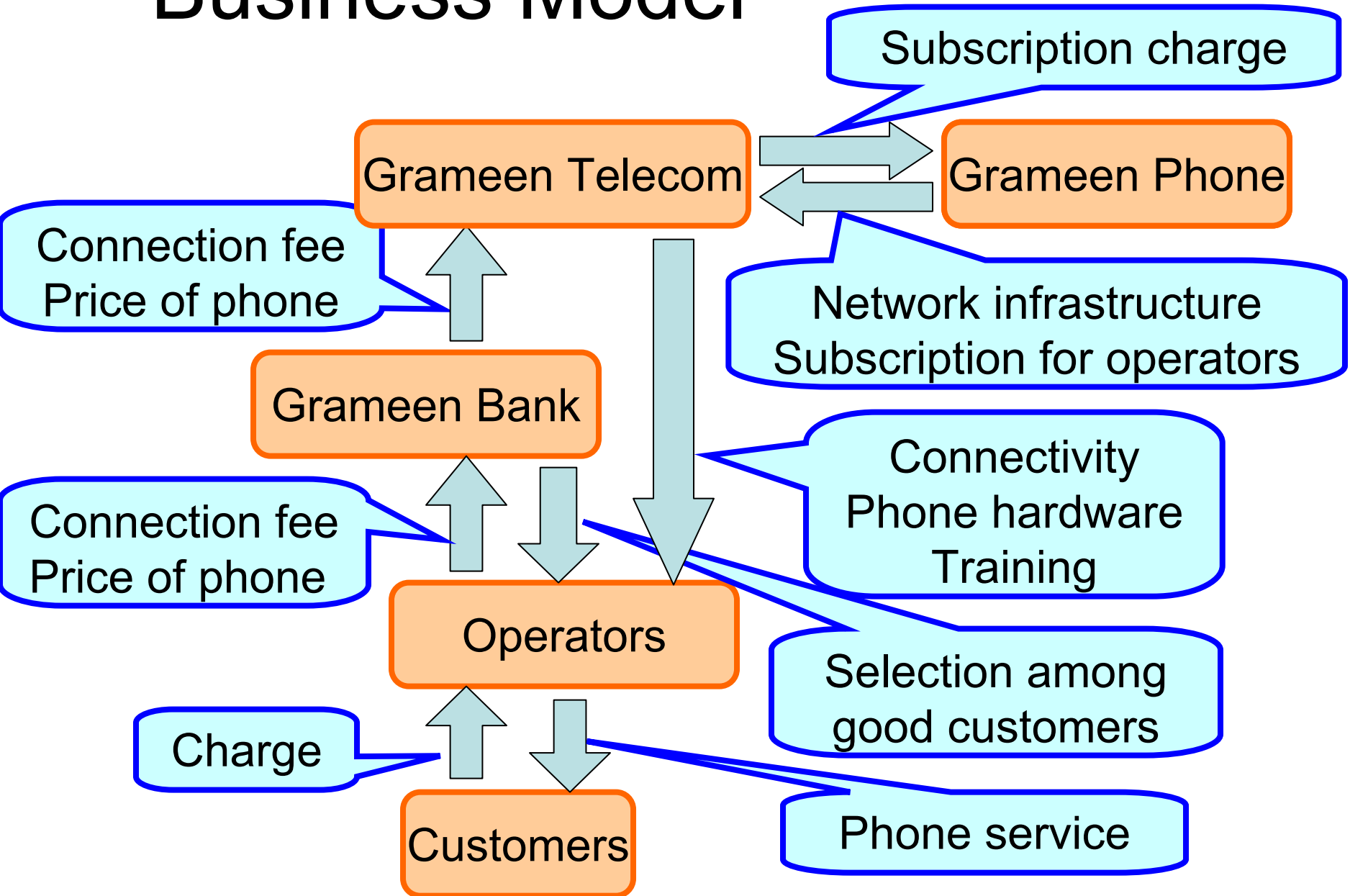
Grameen Telecom

The Village Phone Program

Facts as of November 15, 1999

- 950 village phones in service
- Providing telephone access to more than 65,000 people
- Average usage of 900 minutes per month
 - 400 minutes for outgoing calls
- Each phone operator earned \$40/month
 - GDP per capita is only US\$286
 - They are also poor inhabitants of rural areas.

Business Model



Selection, Subscription and Training of VP Operators

- Local GB branch selects individuals from among its members.
 - Usually women - almost 95% of Grameen Bank members are women.

Selection, Subscription and Training of VP Operators

- Rules for selection
 1. She must have a very good record of repayment of Grameen Bank loans;
 2. She should have a good business, preferably a village grocery store, and have the spare time to function as the VP operator. Initially the telephone would be a side business with the expectation that the operator would eventually switch over to the telecom business on a full-time basis after services and revenue justify a full-time commitment;
 3. She should be literate or at least she must have children who can read and write. Her residence should be near the centre of the village.

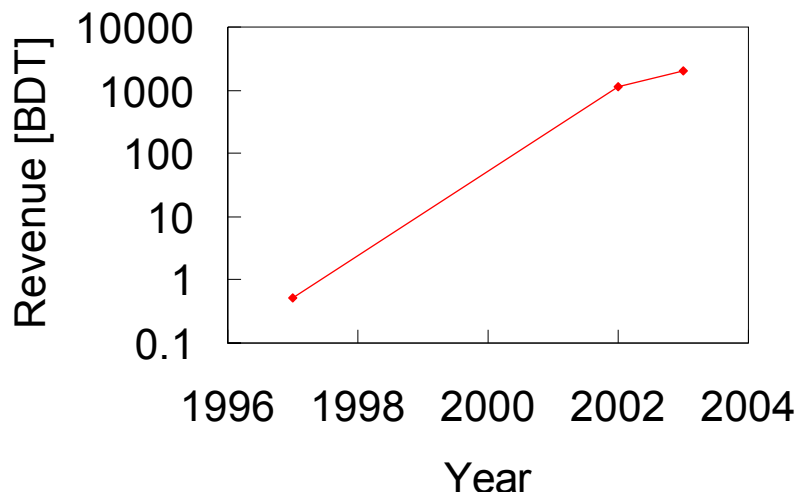
Selection, Subscription and Training of VP Operators

- GTC ensures signal availability in the house or shop
- The member pays the equipment cost and connection fee back to GB within the stipulated 2- or 3-year period through the micro-credit facility's weekly repayment system.

Current Status

- VP Program has continued to grow at a robust pace over the years.
 - 165,000 VP subscribers (Aug. 2005)
- Average revenue per user
 - VP subscriber = 2 x GP business user

- Total Revenue



Current Status

- VPs in operation now provide access to telecommunications facilities to more than 60 million people living in rural areas of Bangladesh.
- “Village phone ladies” make an average of \$71 per month—in a country where the average monthly income is about \$25.



Case Assignment

Cases to be individually chosen among

- ICT Success Stories (WSIS)
http://www.itu.int/ITU-D/ict_stories/
- ITU-D Case Library for Rural Communications
https://www.itu.int/ITU-D/study_groups/SGP_2006-2010/events/Case_Library/index.asp?Lang=en
- ITU-D FG7 library
http://www.itu.int/ITU-D/fg7/case_library/index.html
- ITU-D Rural Telecommunications
<http://www.itu.int/ITU-D/tech/RuralTelecom/index.html>
- Individual source
e.g. cases in your country, your internship experience, etc.

Case Assignment

Submission deadline

- Submit in slide presentation (preferably in PDF) to TA by January 19

Schedule

January 21

- Lecture on Information Technology
- Case presentation of 1 or 2 selected students
 - Presentation for 15 mins / person
 - Discussion for 5 mins / person

January 28

- Case presentation of 4 selected students, or supplemental topic