

# Technical Presentation and Discussions on USPNet Upgrade

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# Presentation Summary

## Summary:

- Digital Communication Lecture (K. Yamamoto)
- The Purpose of USPNNet (K. Moala)
- Technical definition of USPNNet (K. Moala)
- Technical problems of USPNNet (K. Moala)
- Proposed solutions (K. Yamamoto)
- USPNNet Tomorrow and IP based (K. Yamamoto)

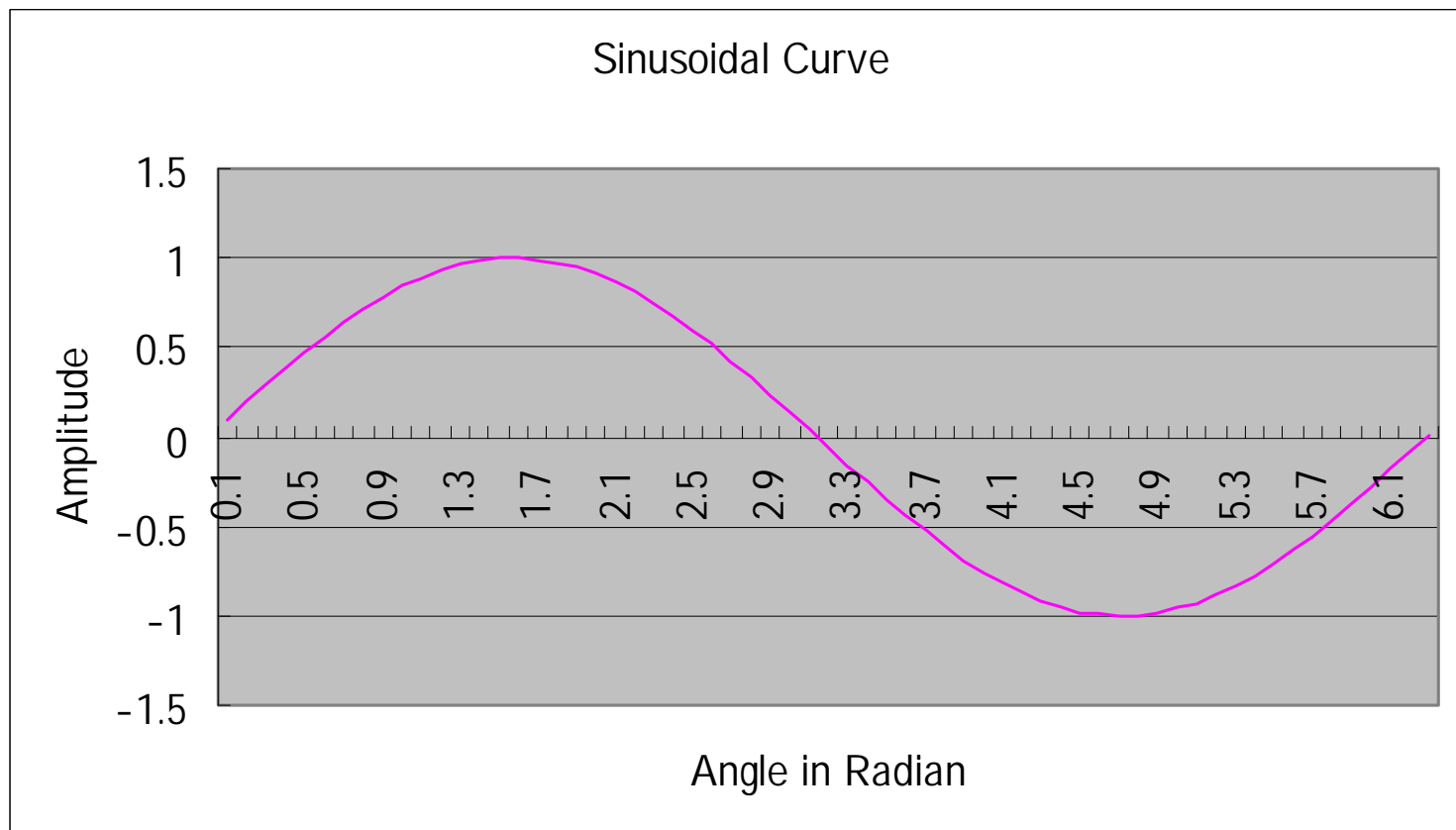
# Digital Communication Lecture

## by Mr. Katsumi Yamamoto

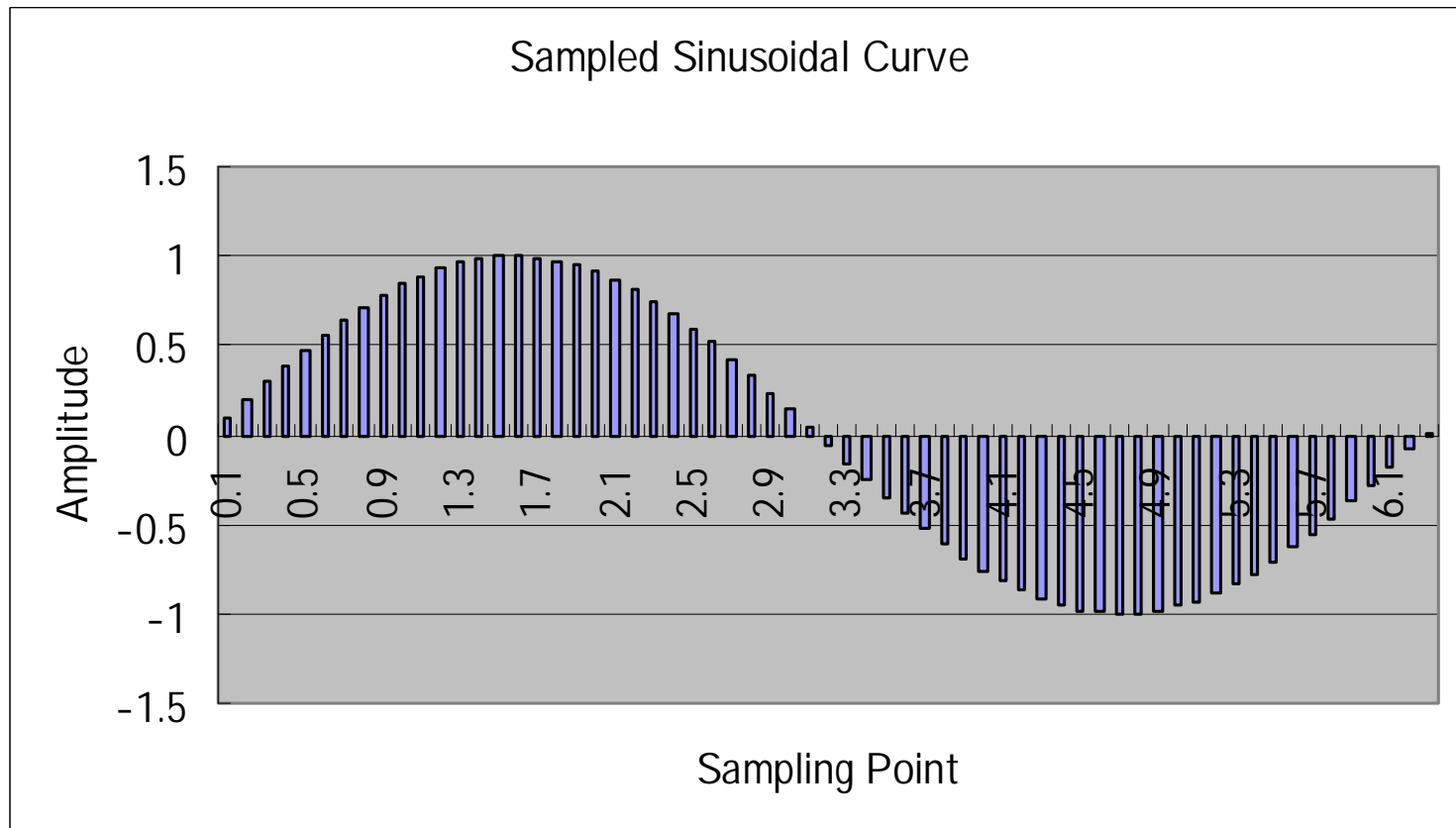
Topics include:

- Analog and Digital
- Data Compression
- Multiplexing
- Digital Modulation
- Multiple Access

# Analaog Signal



# Digital Signal



# Quantization & Coding

Range of Sample		Quantized Value	Binary Code	
Max.	Min.		Sign Bit	Amplitude
1.0	0.875	7	1	111
0.875	0.75	6	1	110
0.75	0.625	5	1	101
0.625	0.5	4	1	100
0.5	0.375	3	1	011
0.375	0.25	2	1	010
0.25	0.125	1	1	001
0.125	-0.125	0	1	000
-0.125	-0.25	1	0	001
-0.25	-0.375	2	0	010
-0.375	-0.5	3	0	011
-0.5	-0.625	4	0	100
-0.625	-0.75	5	0	101
-0.75	-0.875	6	0	110
-0.875	-1.0	7	0	111

August 20, 2002

USPNET Evolution Plan / JICA USF

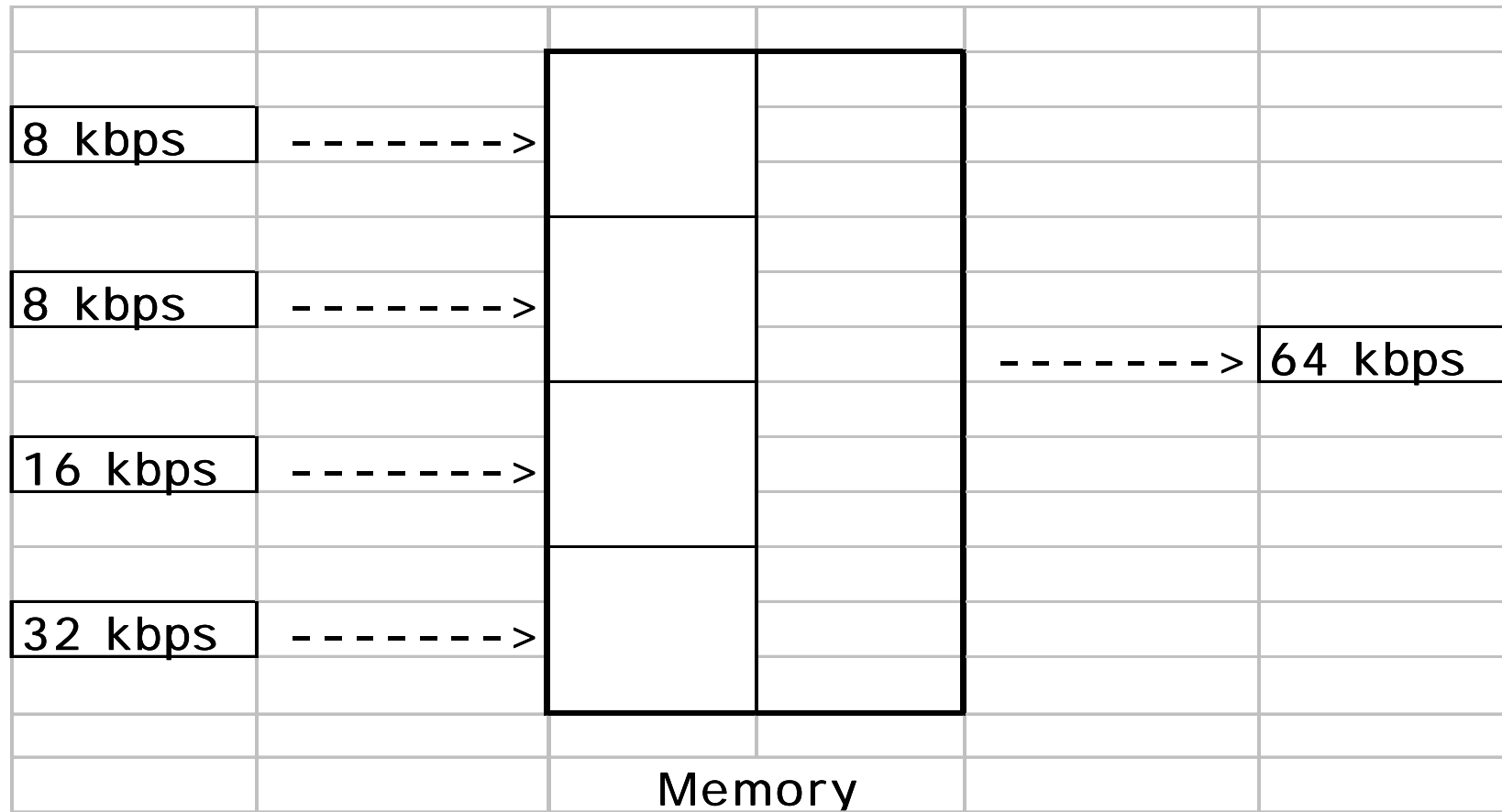
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Project

# Data Compression

- Removal of Redundant Information
  - Silence between voice spurt
  - Very high and low frequency components
  - Still back ground in Video
- Adaptive Forecast with feedback
  - Forecast based on human voice statistics
  - Forecast based on movement of Picture

# Multiplex



# Digital Modulation

## PCM (Pulse Code Modulation)

- PSK (Phase Shift Keying)
  - BPSK
  - QPSK
  - 8-PSK
  - 16-PSK
- QAM (Quadrature Amplitude Modulation)

# Multiple Access

## Resource Sharing without Data Collision

- TDMA (Time Division Multiple Access)
  - Carrier Sense Random Access
  - Pre-assigned TDMA
  - Reservation TDMA (Dynamic TDMA)

# Purpose of the USP(Net)

## Question for USP Management:

What are USP's major strategies for the next five years?

Answer: *“The core strategies of USP can be grouped under five themes namely, serving the region, student focus, quality, flexible teaching and learning and effective and efficient resource management” DVC*

# Purpose of USPNet con't.

Technical interpretations of our goals:

- Expandability (cover the whole region)
- Flexibility (flexible to changing demand)
- Availability (available to all USP students)
- Quality (user satisfaction)
- Efficiency (cost-effective solution)

(In short “EFAQE” is the effect of our goal)

# Technical definitions of USPNet

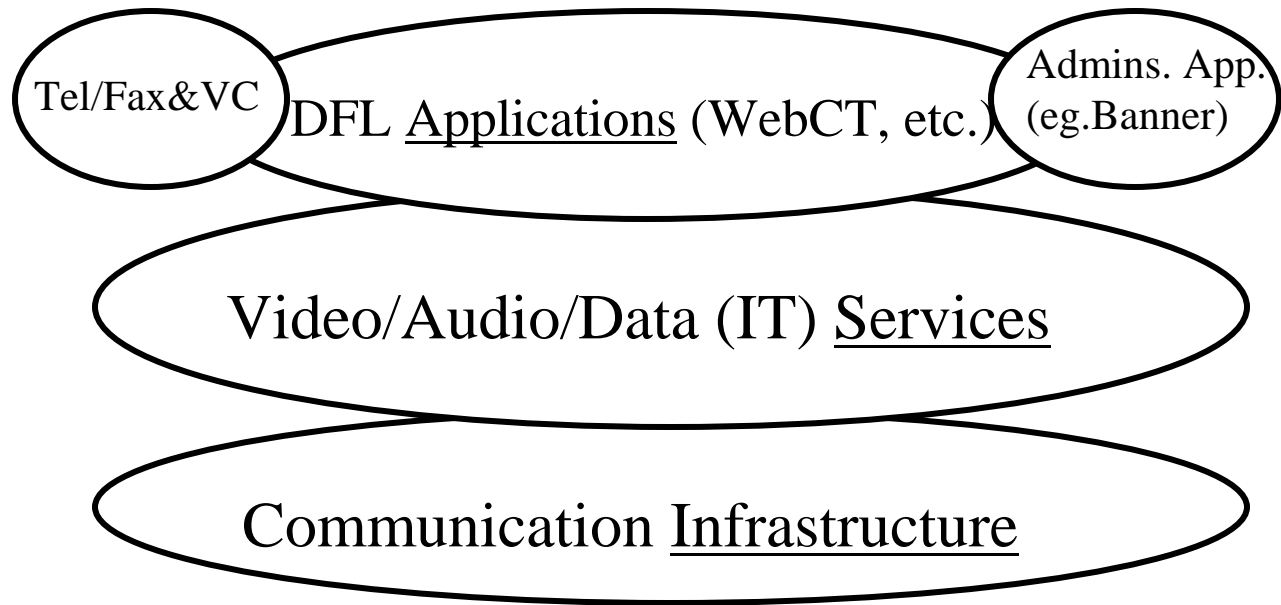
- Print-based system for distant students
- Before 2000 - Audio (and Data) Networks via Telecom leased lines to USP Centers
- USPNet 2000 (VSAT network delivering Audio, Data and Video networks)
- Proposed Technical definition of USPNet

# New Definition of USPNet (Total Communication Network)

Relates to  
OSI 7-Layer  
Model/ICT:

“USPNet can be defined as a group of supporting networks to deliver DFL Application Services for the USP’s DE”

Application  
Presentation  
Session  
Transport  
Network  
Data  
Physical



**Figure 1: New Definition of USPNet**

# Technical Problems of USPNet

- Limited USPNet 'SERVICES' beyond USP Extension Centers (Access and Expandability)

## Points of Discussion:

1. What are 'USPNet Services'? (Priorities)
2. How best can we provide such Services to all our students? (Availability of Technologies)
3. Where can we set the balance between providing Quality Services and Access by all USP students?

# USP Students - Distribution/FIJI

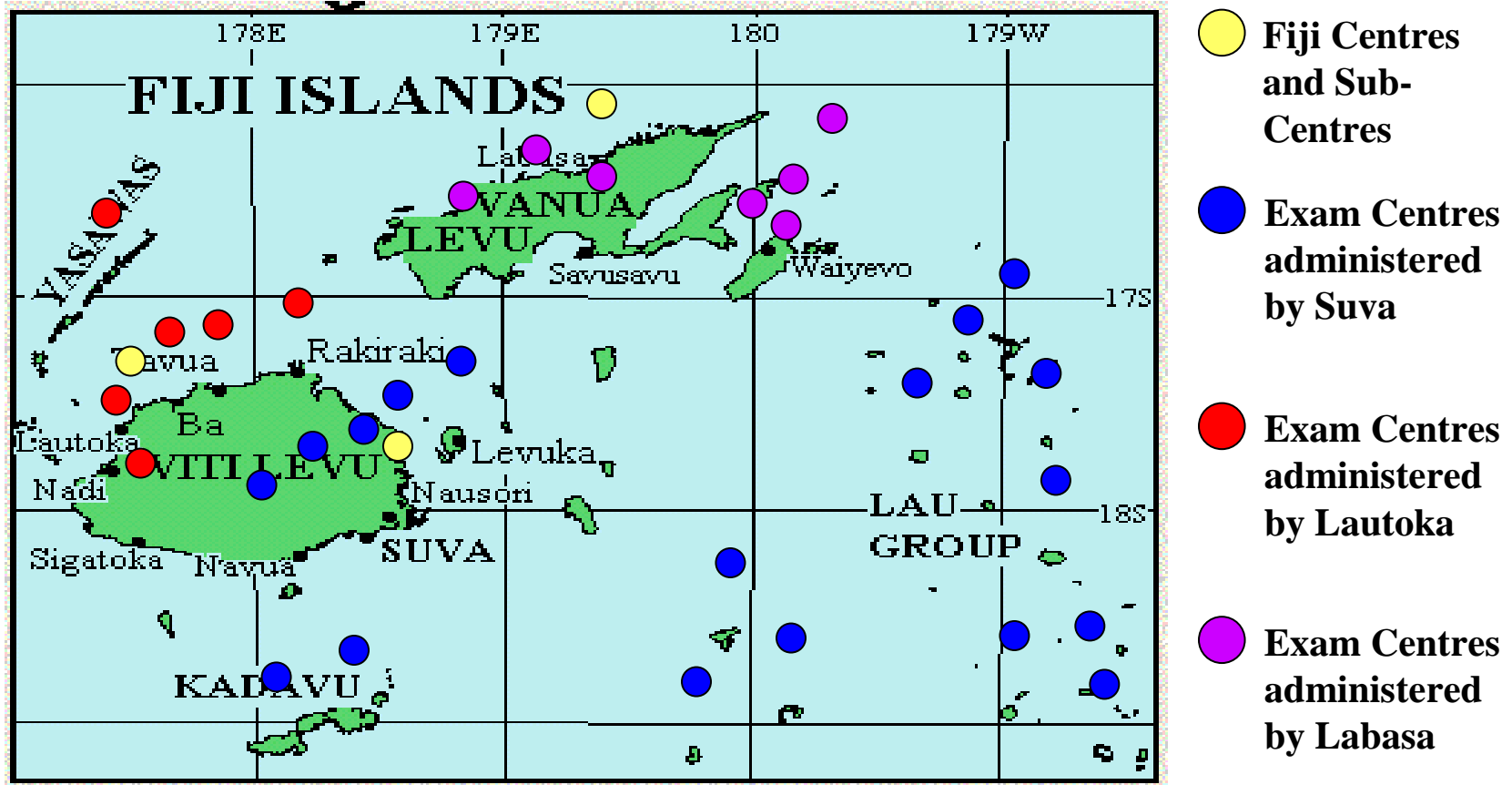


Figure 4: USP Students ‘outside’ USPNet (Expandability)

# Technical Problems of USPNet

- Limited USPNet services beyond the Centers
- Limited Bandwidth (Intranet and Internet)
- In-efficient use of (Video) Bandwidth
- Unstable power supply for earth stations
- Technical Design of Common Infrastructure
- Technical Training of Human Resources
- Technical Operation and Maintenance
- Others ... (Discussion Point) ...

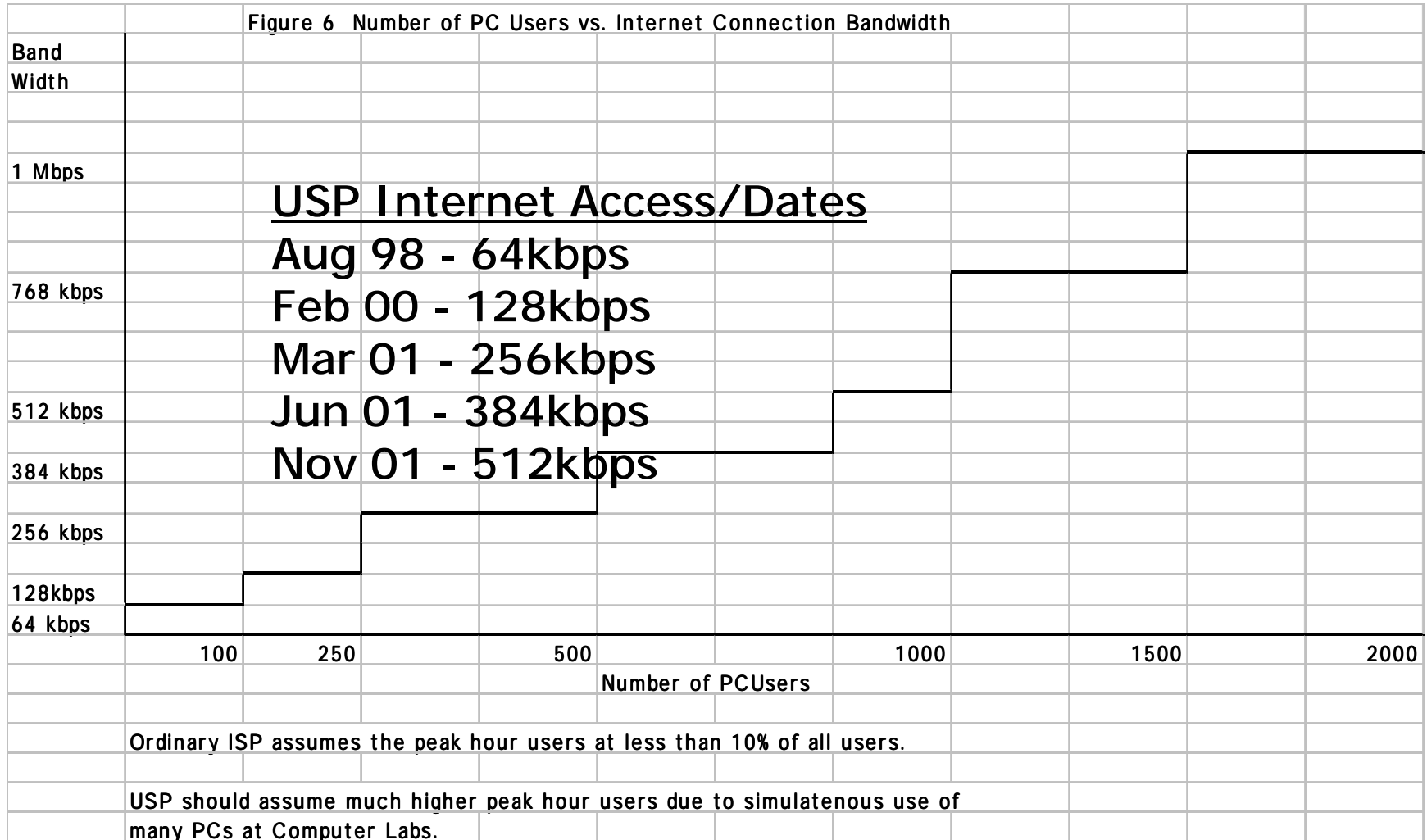
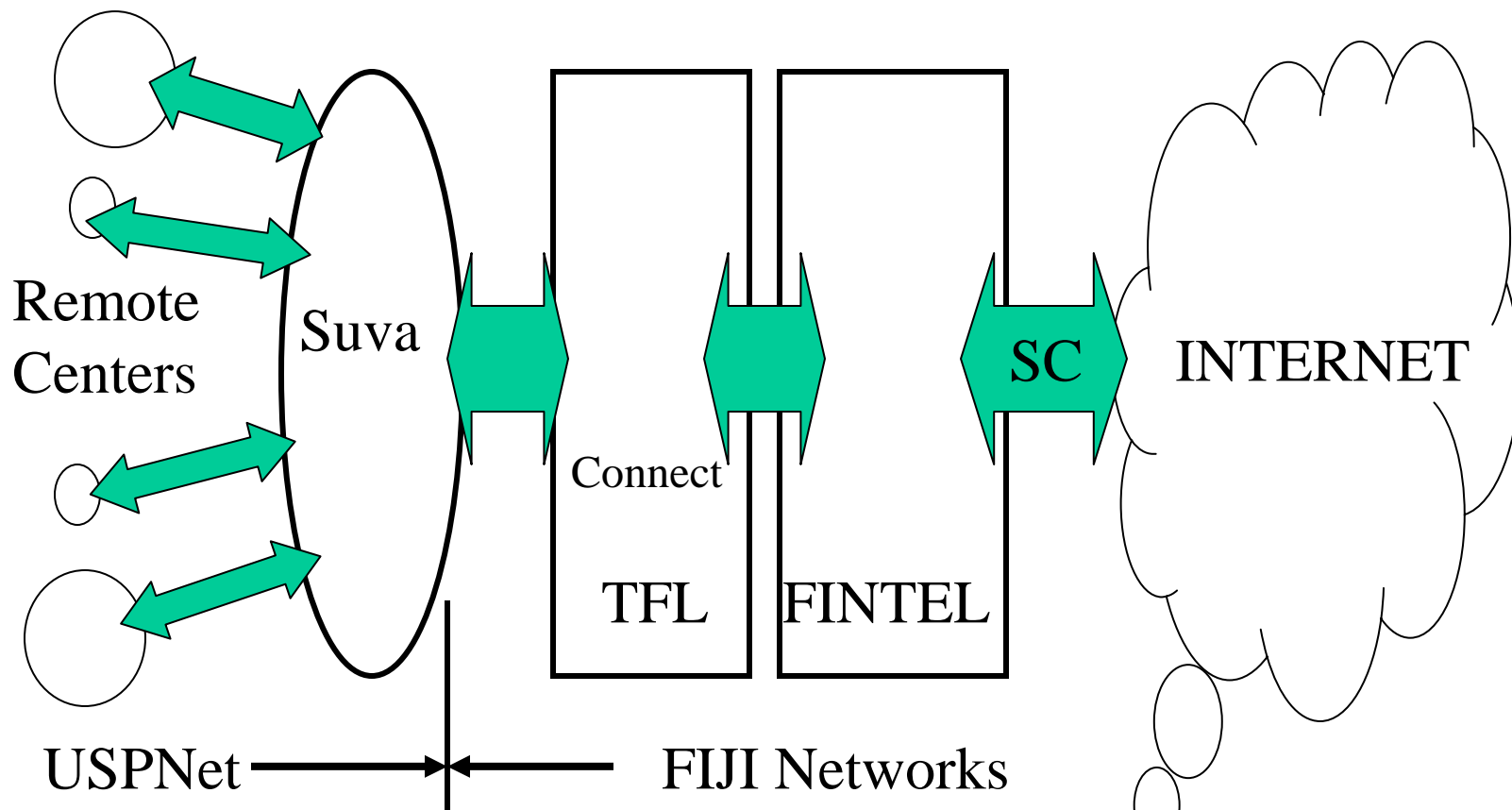


Figure 6: No. of PC Users vs. Internet Connection Bandwidth

# Potential Short Term Solutions

- Telephone Conferencing via PSTN
- Cheap satellite TVRO Terminals
- More flexible and full time use of Video channels
- Software upgrade of Videoconference equipment
- Introduction of self supportive power supply for Hub Earth Station
- Hybrid (Satellite) connection to ISP Gateway

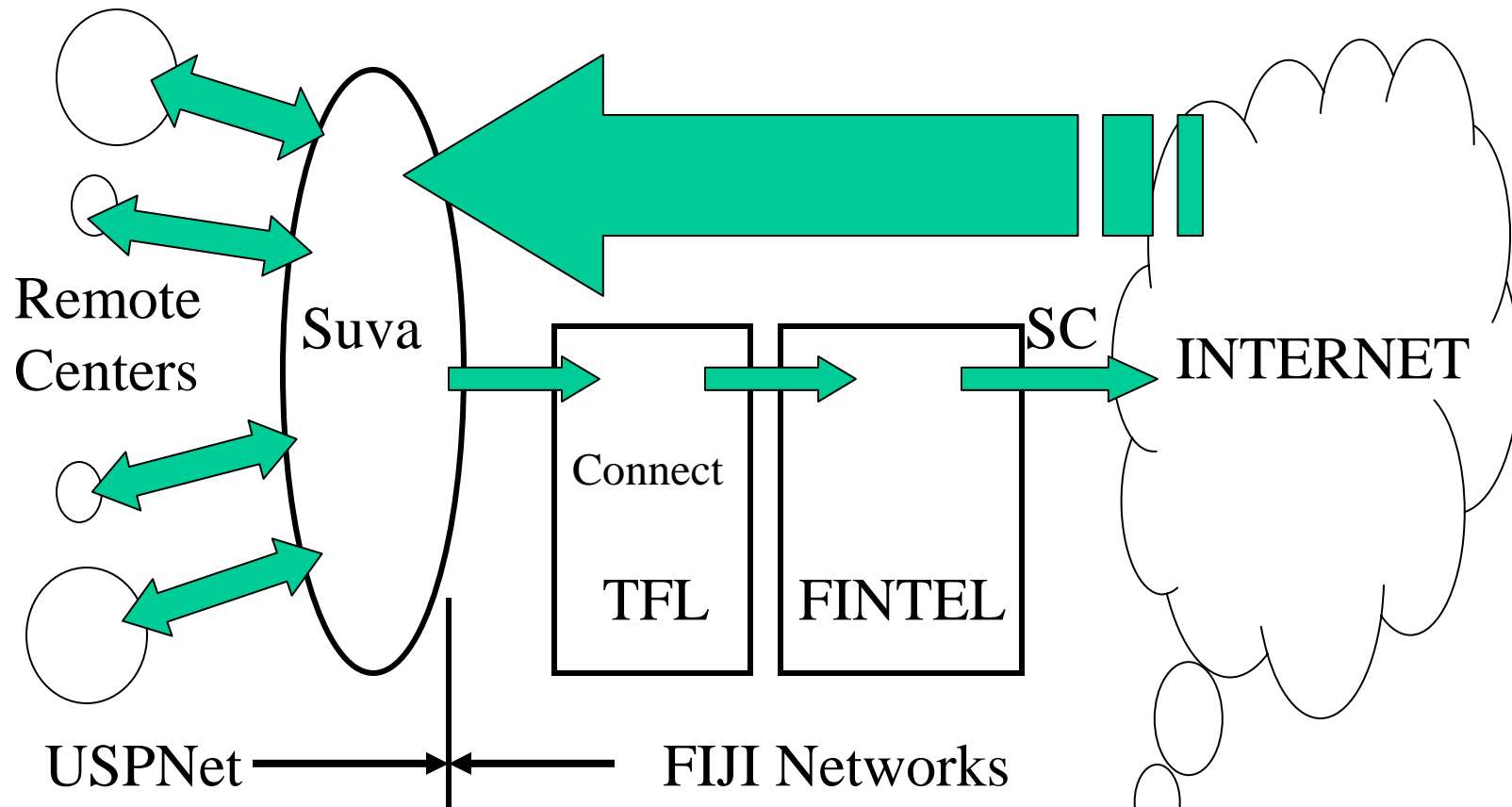
# USPNet - Internet Access Option(1)



Note: This is Symmetrical Transmission

Figure 8.1: Internet Access via Southern Cross OF

## USPNet - Internet Access Option(2)



Note: This is Asymmetric Transmission (also to any site!)

Figure 8.2: Internet Access via Satellite/INTELSAT

# Mid to Long Term Solutions towards IP-based USPNet

- Fully flexible satellite resource allocation (Figure 9)
- Replacement of Multiplex equipments by Routers (Figure 10)
- Transition of fixed bandwidth based services to IP based services (Figure 11)  
(Video/Audio Systems, Telephone/Facsimile Systems)

# Flexibility of Satellite Network and Hub (1)

## Frequency (C Band Global Beam)

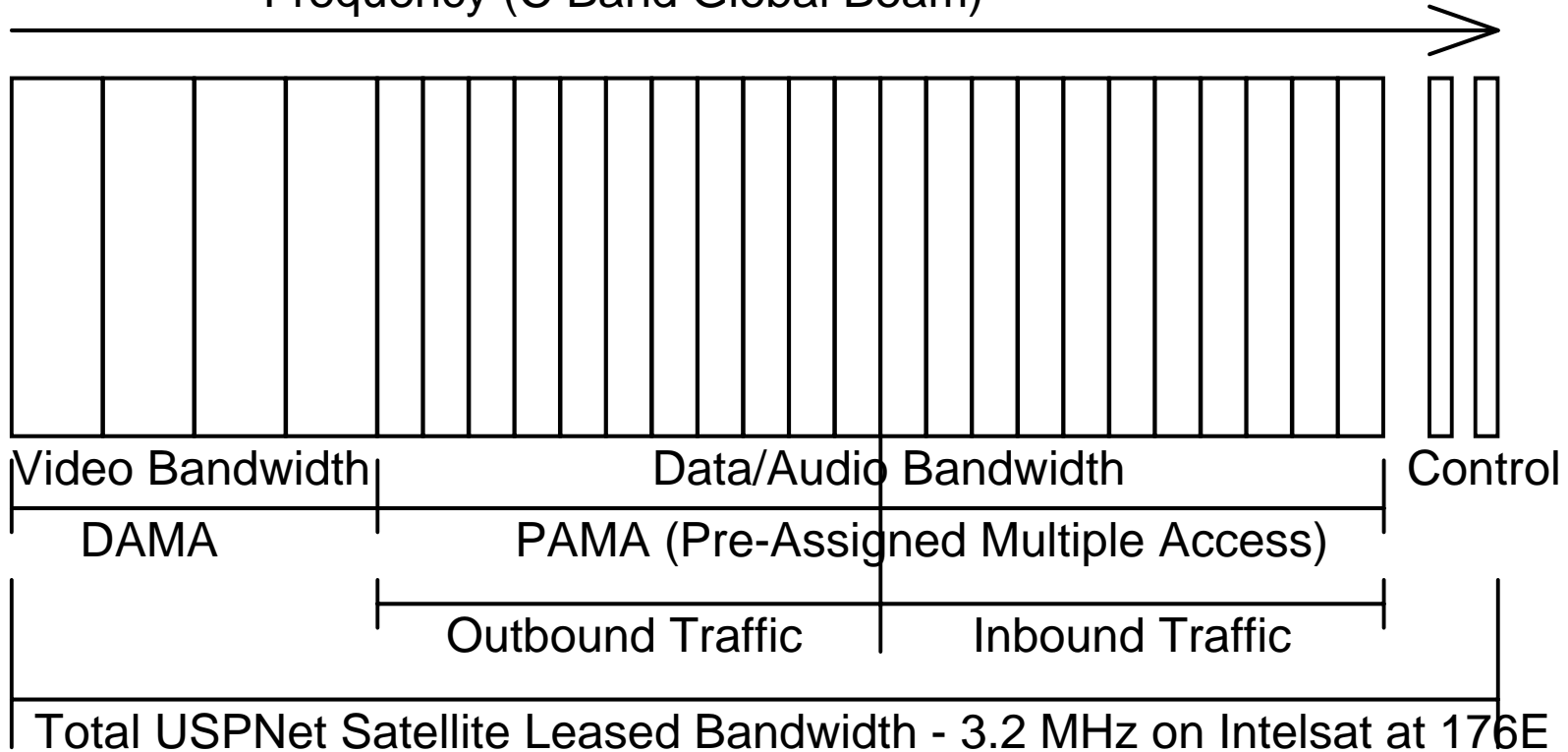
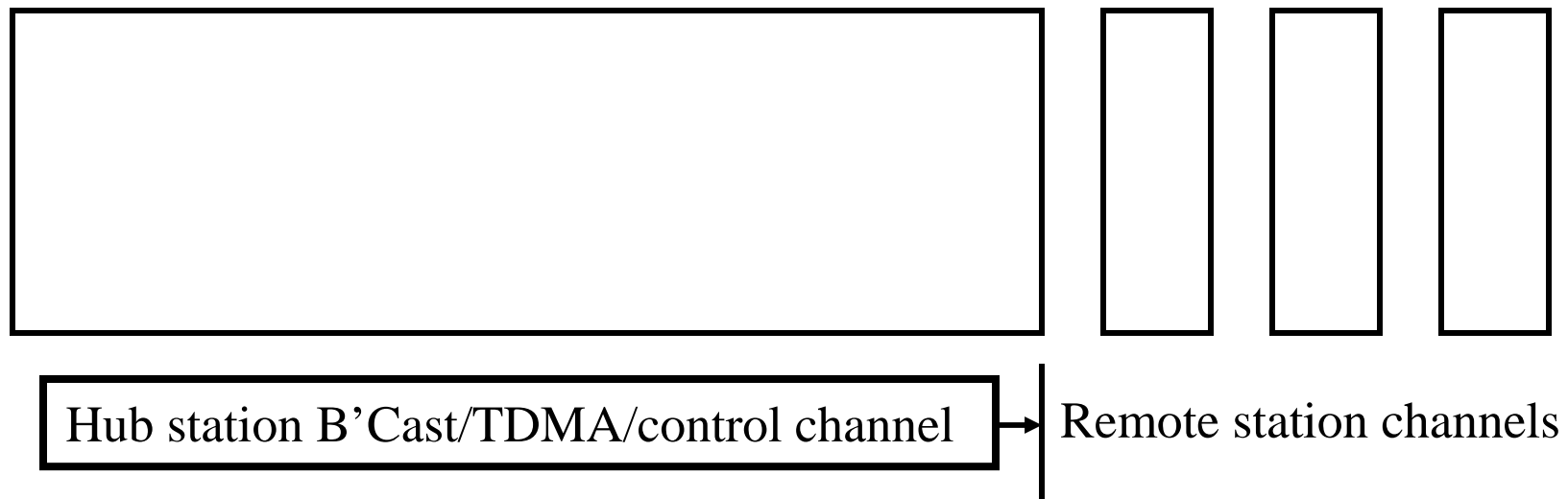


Figure 9.1: Existing FDMA/SCPC Allocation (Fixed)

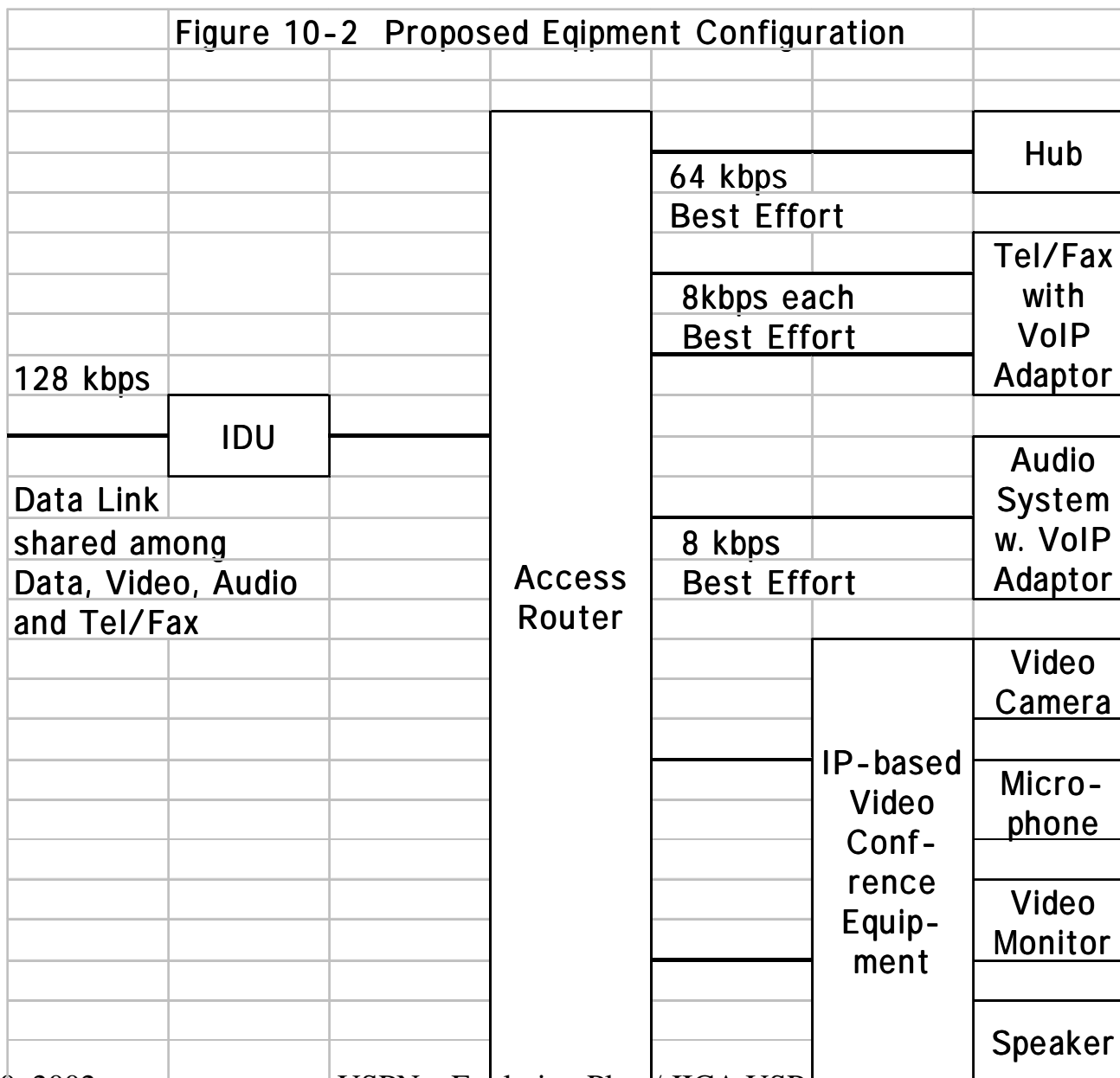
## Flexibility of Satellite Network and Hub (2)



Actual satellite spectrum/bandwidth depends on demand

Figure 9.2: Future TDM/TDMA Allocation (Dynamic)





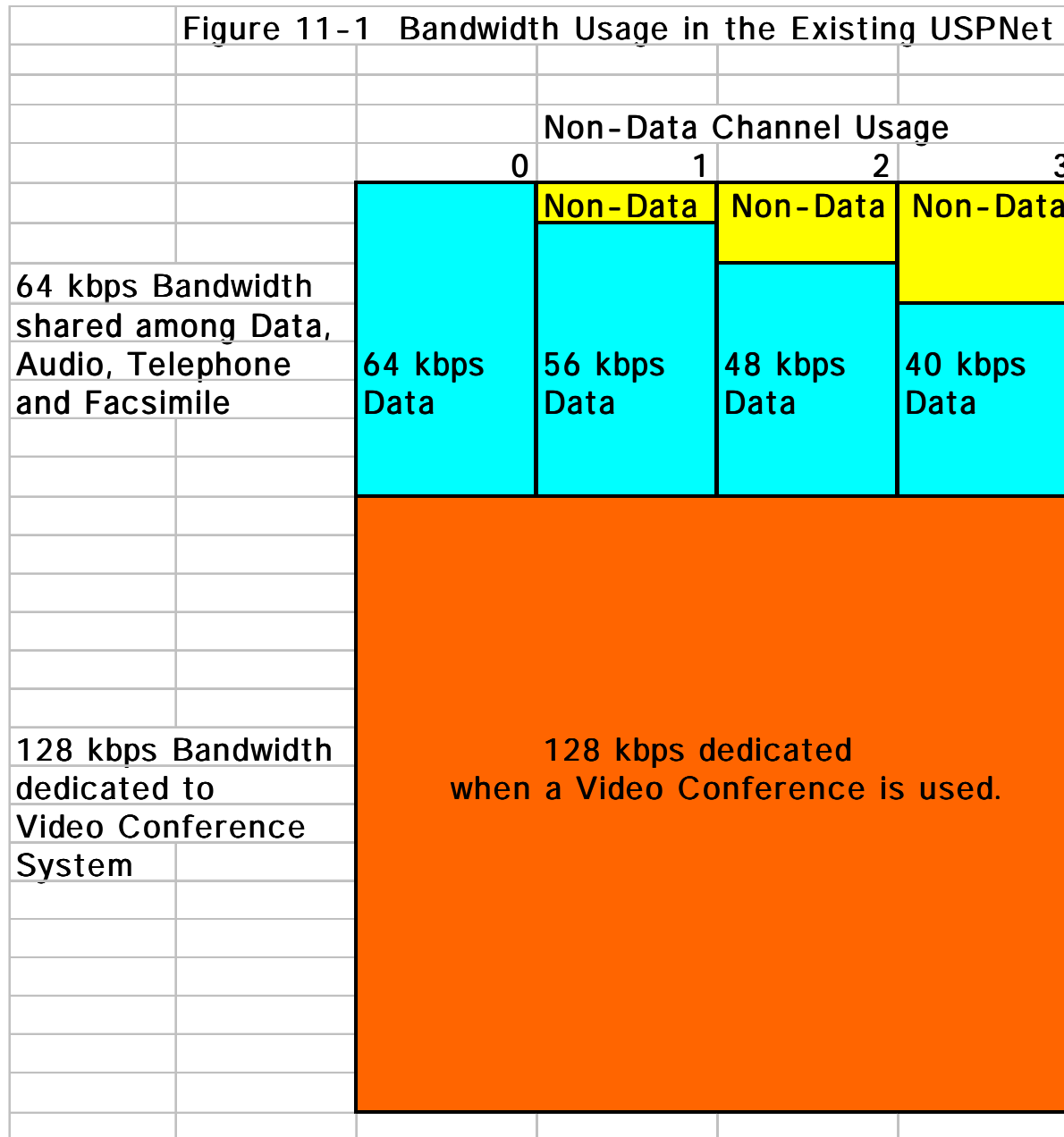


Figure 11-2 Bandwidth Usage in the Proposed USPNet

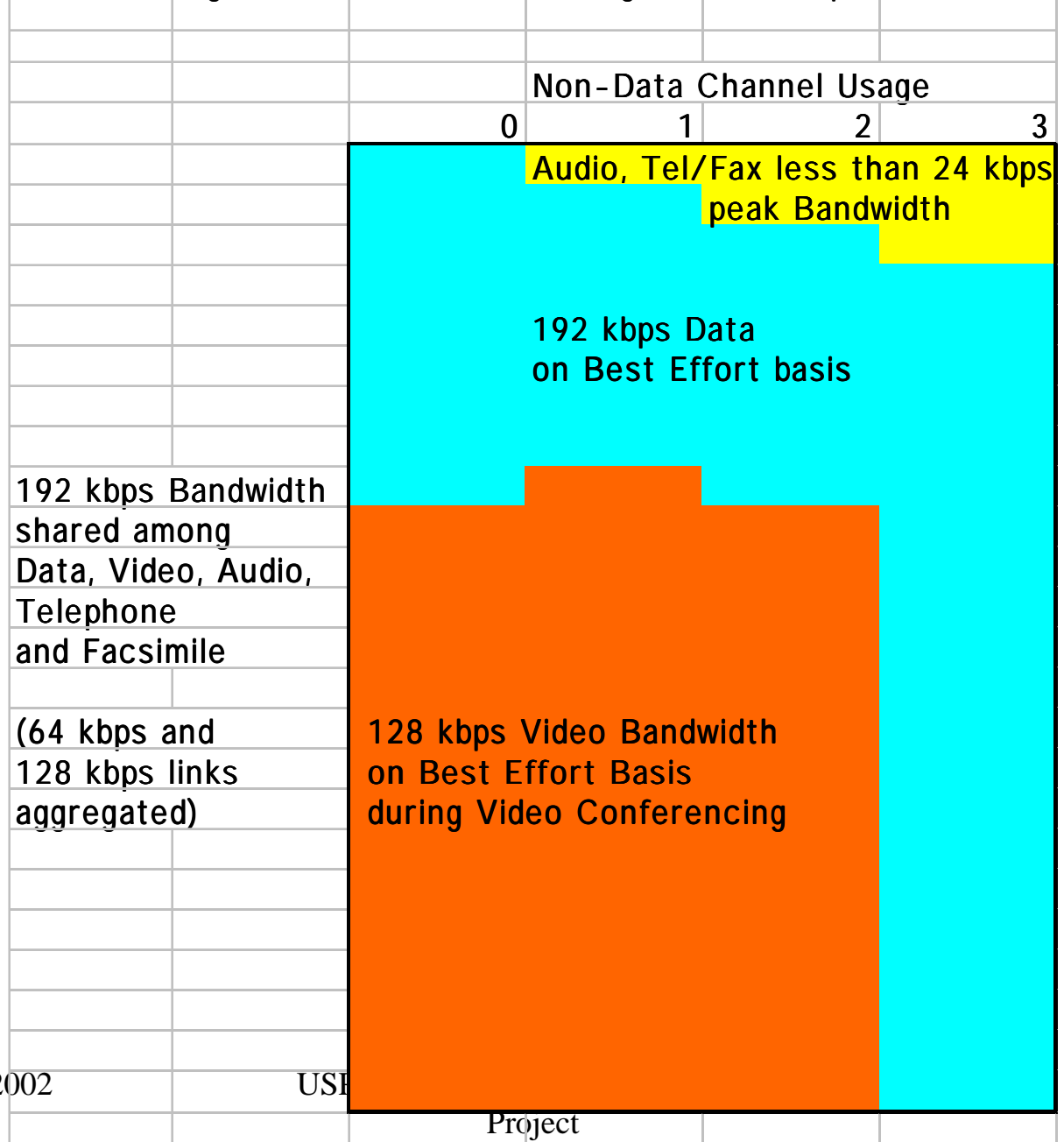


Table 5 Problems and Solutions			
Problems	Short Term Solutions	Mid to Long Term Solutions	Consequences
Limited Service beyond the Extension Centres	PSTN Telephone conferencing	TV Receive Only Terminal Wireless Local Loop	TVRO and Wireless Local Loop require permission from Ministry, and subject to licence fee
Data Bandwidth Limitation	Laucala LAN Enhancement More flexible use of Video channels	Bandwidth sharing among services by Introduction of IP-based network	Bandwidth sharing on the satellite requires replacement of many earth station equipment
Low quality VGA/Video conversion	Enhancement of VGA/Video converter	Introduction of PC cooperation system on the network	Cost implication
Unstable Power at Hub Earth Station	Introduction of UPS and Engine Generator at Hub		Cost implication
Internet connection bandwidth limitation	Connection to a major ISP on a continent USPNet Evolution Project	Plan / JICA USP	Bypass of local ISP requires appropriate permission from Ministry

# Key Points to Success

- Careful and realistic planning
- Step by Step Confirmation of each task  
(Plan-Do-See Process)
- Allocation of appropriate human resources
- Well prepared justification data for the project (Cost-Benefit, Beneficiaries, etc.)

# Sample Cost-Benefit of Technology

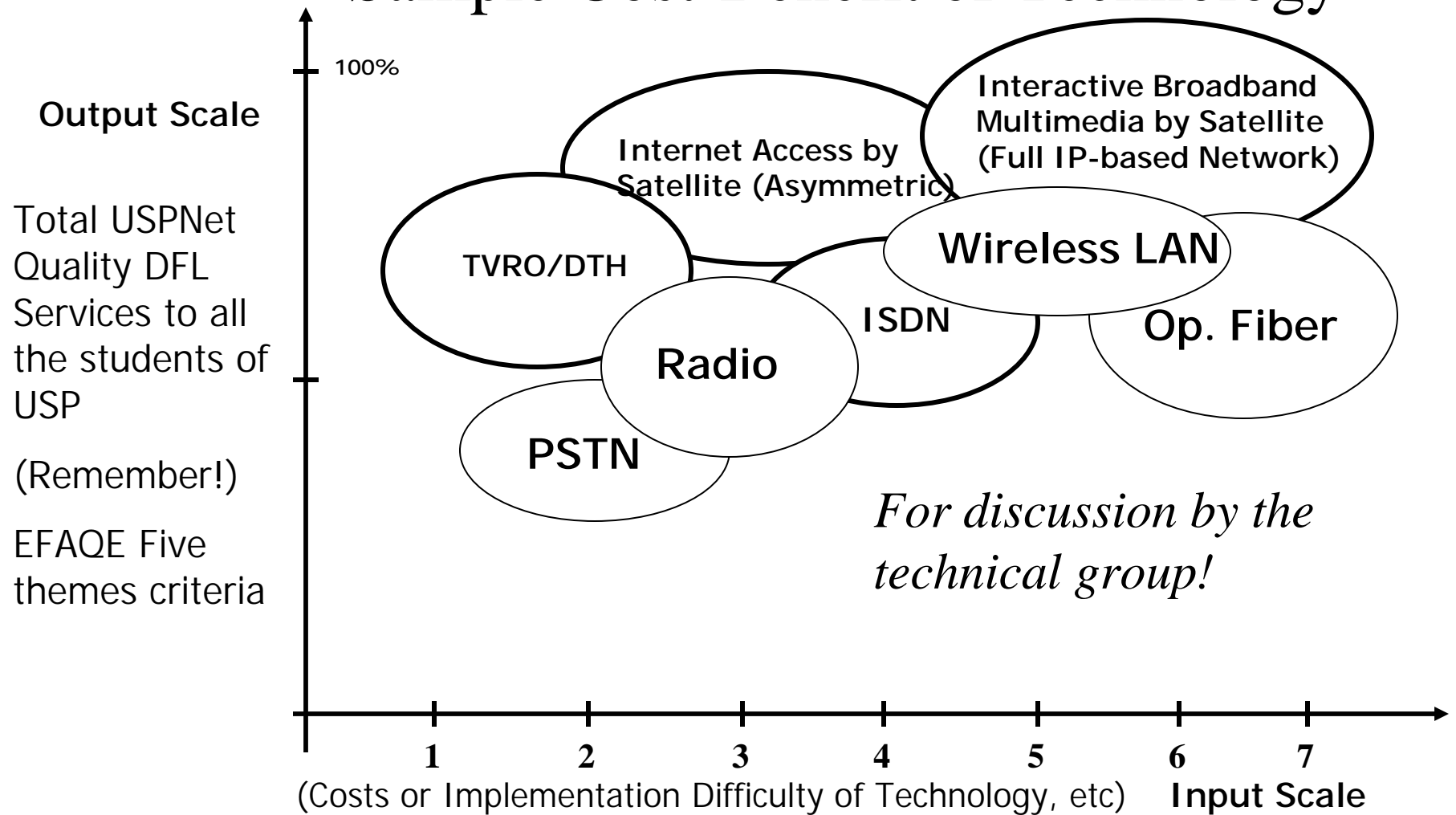


Figure X: Cost Benefit Analysis of Solutions

# Open Discussion (Issues)

- Where do we go from here?
- What is the most cost-effective solution?
- What is the priority of tasks for USP/JICA?
- How can we allocate our limited resources?
- What about TRAINING of HR?
- The long-term future of USPNet ..