

Upgrading USPNNet

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Outline

- ◆ Motivation of upgrading infrastructure
 - Current USPNNet situation and consideration
 - Switching to IP based environment
 - ◆ Broadband connectivity
 - Remote sites
 - ◆ Satellite connection (Gilat solution)
 - ◆ Consideration on IP aware services
 - IP telephony
 - Video and audio conference systems
 - ◆ Priority control, Multicast
- ◆ Resources and milestones
 - Milestones
 - Human and equipment resource consideration

Before I Begin: [Short, Middle, Long] Solution

- ◆ Upgrading project started in 2002
Short term solution ended in 2003 ?
 - ◆ How are the situation?
 - Some are delayed, some are obsolete...
 - ◆ Technology update >> solutions
- ◆ Combining short and middle solution
We will have effective upgrade with more profits. = new era

Motivations of Upgrades

- ◆ Technological view
 - ◆ To implement stable and broadband network connectivity with
 - Broadband capability
 - Scalability
 - stability
- ◆ For educational and research view
 - ◆ Intellectual contents world-wide are digital and IP encapsulated
 - Access via Internet is the prerequisite condition
 - The fastest and confidential way of sharing knowledge
 - ◆ Environment for intellectual activities requires:
 - Stable Internet access
 - Fast Internet access
 - Scalable Internet access
- ◆ Administration view
 - ◆ More flexible and better communication infrastructure
 - With faster accessibility
 - Scalable communications, conference systems

Contribution of JICA

- ◆ What JICA has contributed since the project started

- ◆ Equipment resources
 - Replacement of hub and remote sites
 - ◆ Routers, Switches, PCs
- ◆ Human resources
 - Long and Short term experts
 - Advisors

What we still need to contribute?

- Equipment resource for the proposal
 - ◆ Satellite communication infrastructure upgrade
 - ◆ Human resources

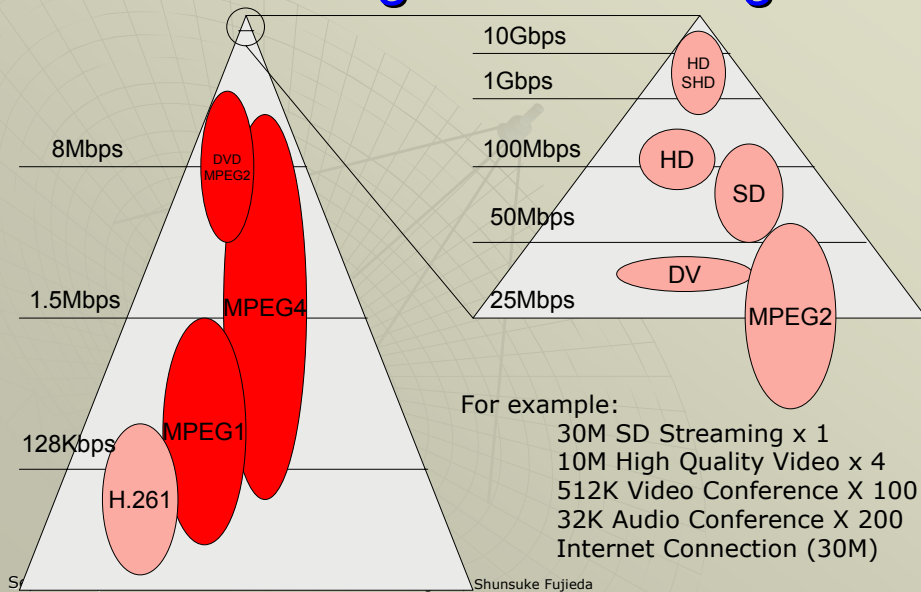
To do List

- ◆ Limitation in network bandwidth
 - Connection to remote site
 - ◆ Satellite frequency bandwidth
 - 3.2MHz
 - ◆ Requires optimized and efficient utilization
 - External connectivity
 - ◆ 1.5Mbps
 - ◆ Broadband solution
 - ◆ Connection to World-wide R&E Network(AARNET)
- ◆ Efficient utilization in use of network bandwidth
- ◆ Upgrade with **stability**
- ◆ Consider **Lifetime** of an upgrade (3 - 5 years)
Cost efficiency

Next Slide: Solutions

AARNET is Coming!!

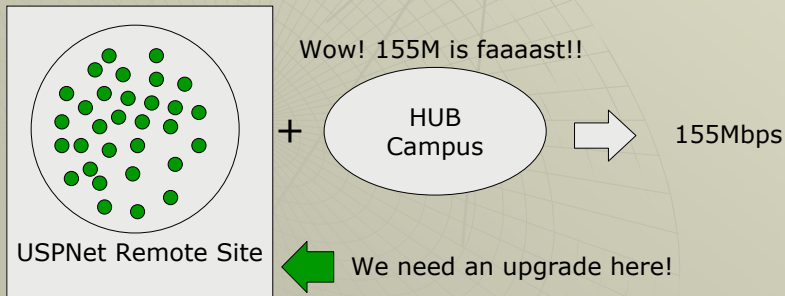
Focusing on Streaming



AARNET

- ◆ 155Mbps external connection
Broadband-aware application
Video and audio to external connection

We need more broadband!!



Current USPNet Consideration

Upgrading Satellite Link

- ◆ With maximum profit and minimum effort :

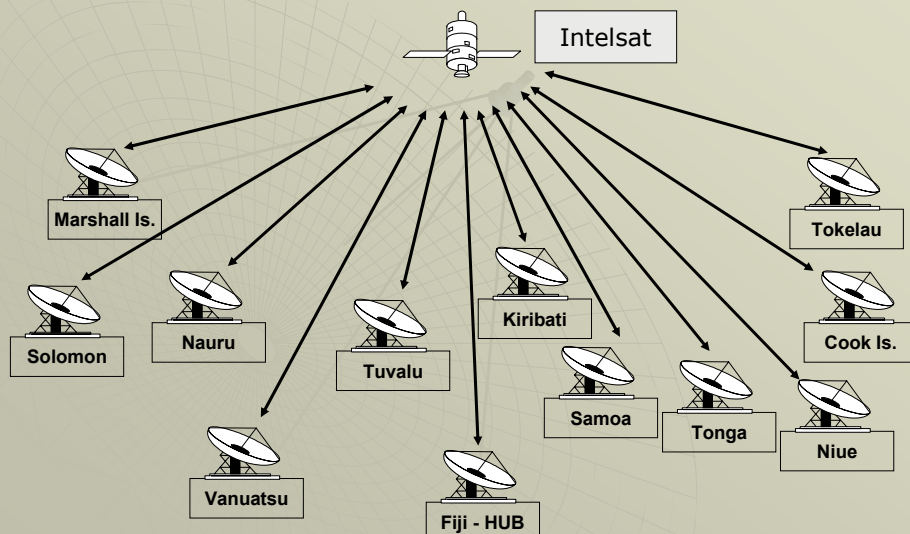
Satellite link design

Frequency bandwidth allocation

Network bandwidth allocation

- ◆ Uni-directional (downstream)
- ◆ Bi-directional (upstream)

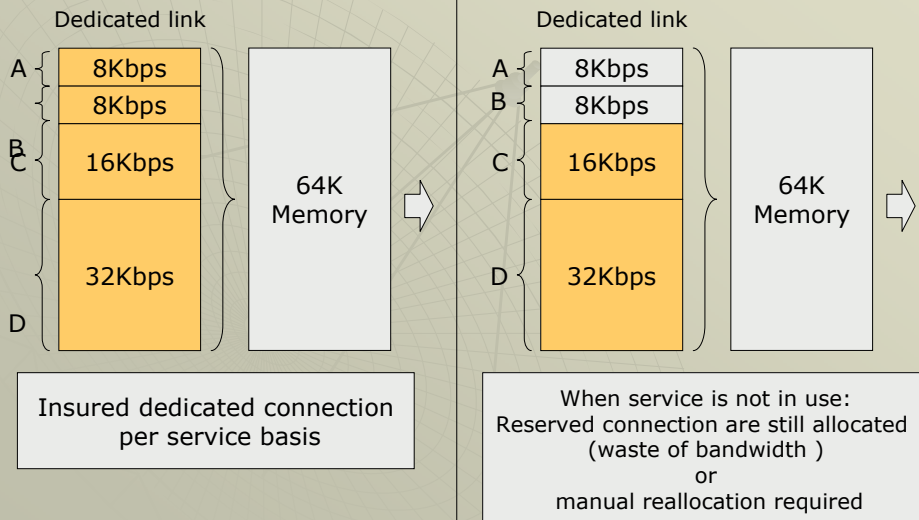
USPNet Satellite Link

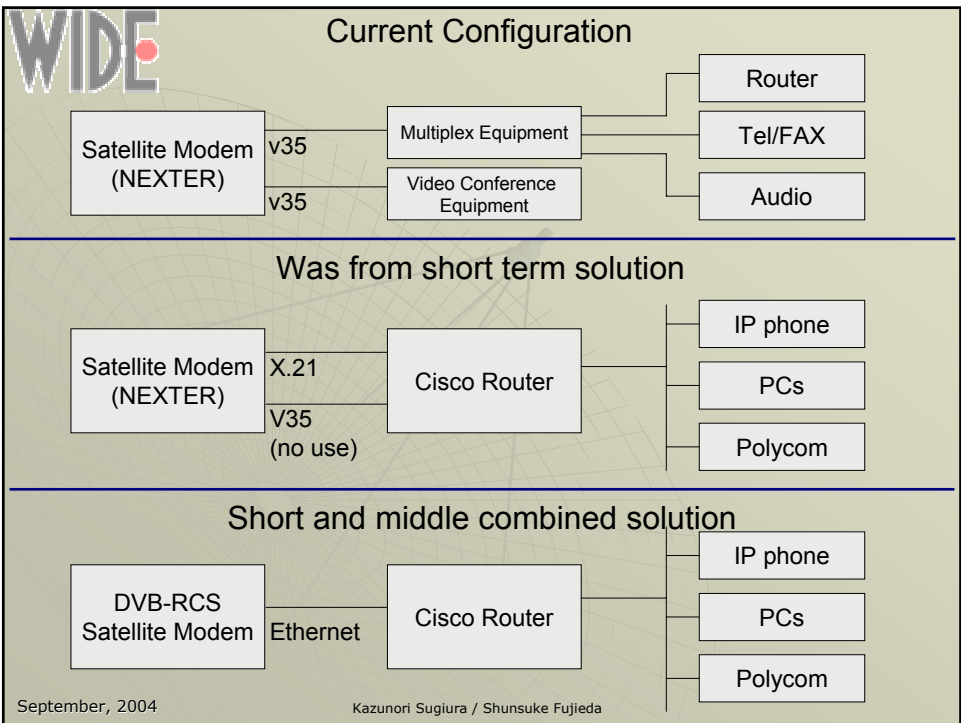
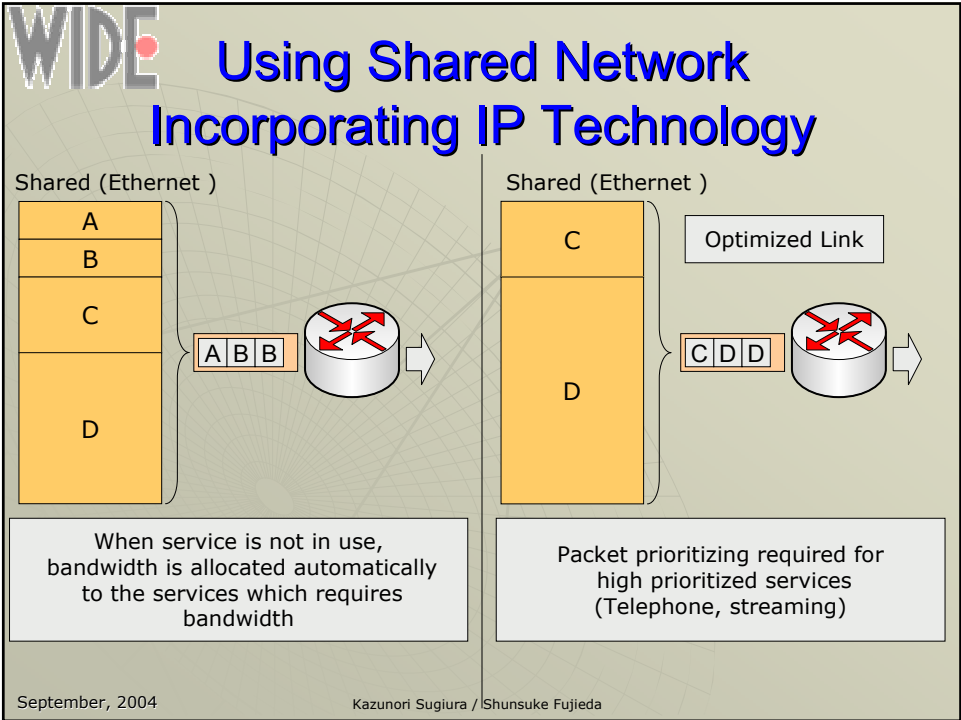


Why Current USP is so Tight?

- ◆ In-efficient use of bandwidth
 - Frequency bandwidth allocation
 - Point-to-point link (Link)
- ◆ Mixed technology
 - Different link in different media
 - ◆ Telephone --- PABX in V.35
 - ◆ Polycom --- V.35 interface connection
 - ◆ Internet
 - Using dedicated circuit design

Dedicated Bandwidth with Multiplexing





Competitive Satellite Modems (IDU)

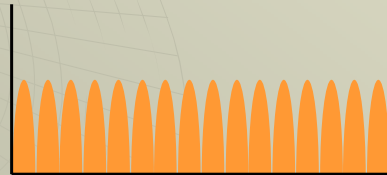
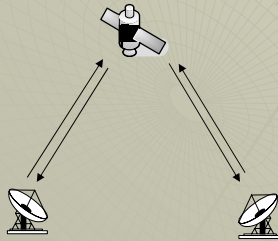
- ◆ Many manufacturers, models
 - ◆ Comtech
 - Vipersat
 - ◆ AUSPACE
 - ◆ GILAT
 - ◆ Others
 - IPStar
 - Other minor providers
- ◆ How we consider the best appropriate solution?

Satellite Internet

- ◆ Design: 3 patterns
 - Point to Point Link (Traditional system)
 - ◆ Individual link connects two earth stations bi-directionally
 - Uni-directional Link
 - ◆ Dedicated sender with countless receivers
 - DVB-RCS
 - ◆ Digital Video Broadcast with Return Channel System
 - ◆ Uni-directional Link **with narrowband return channel**

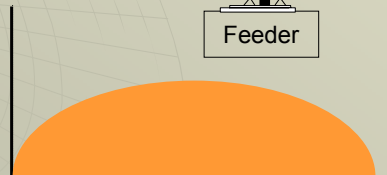
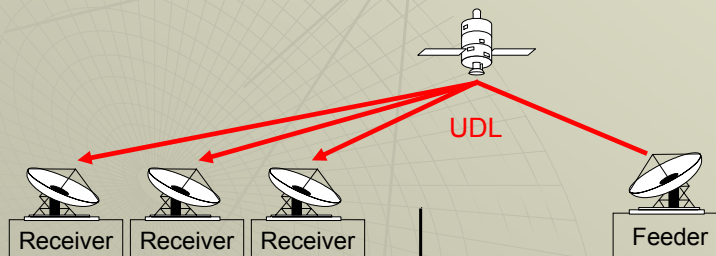
Point to Point Link

- ◆ For minimal bi-directional connection
- ◆ For equivalent connection



Uni-directional Link

- ◆ Used for broadcasting method

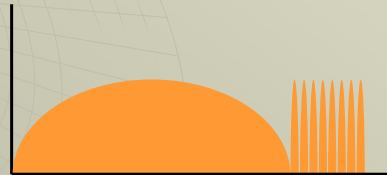


DVB-RCS

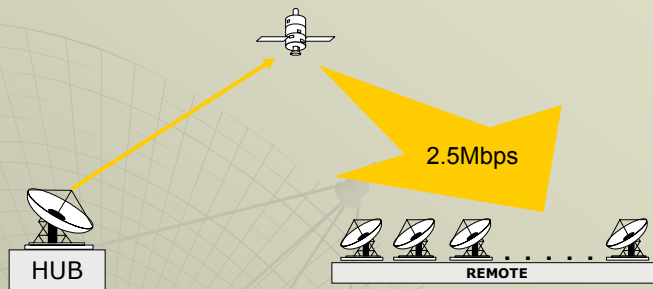
- ◆ New technology

Combination of

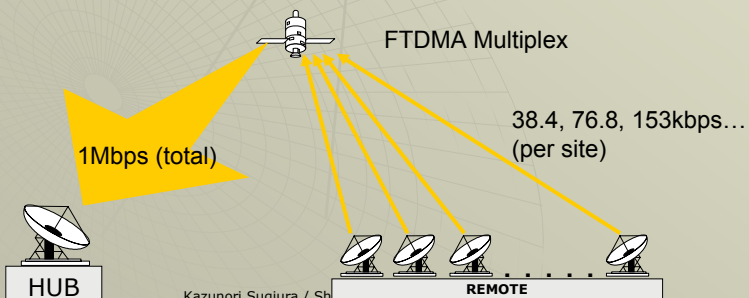
- ◆ Point to point link (incoming)
- ◆ Broadcast (outgoing)



Outbound



Inbound

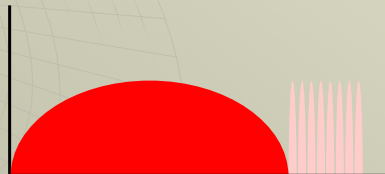


Design of Satellite Internet

- ◆ What matters? : Bandwidth
- ◆ How we can design
 - Actual traffic pattern
 - Satellite infrastructure design } Balance
- ◆ Traffic pattern = Usage
- ◆ Point:
 - How are we going to use the network?
 - Service requirement for network infrastructure

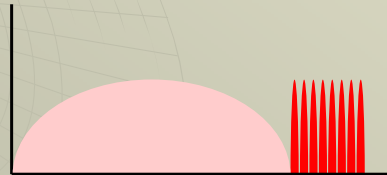
Outgoing Traffics to Remote

- ◆ For a better internet accessibility
 - Effective bandwidth allocation for outgoing traffics for Internet applications (WWW, FTP)
 - ◆ DVB-RCS
- ◆ High quality video, and audio from HUB to remote site



Incoming Traffics from Remote

- ◆ Telephone lines
Requires highly prioritized connection
- ◆ Bi-directional video conference
- ◆ Incoming connection for Internet applications

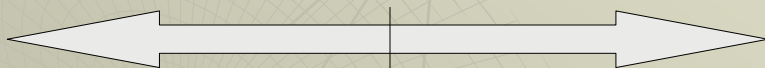


Balance: Incoming and Outgoing

Broadband
outgoing

How much bandwidth do we need?
Allocation?
Future Extendibility?

Broadband
incoming



TV-style
streaming

WWW
E-mail

Telephony

Video
conference





Bandwidth Calculation Estimation

- ◆ Simultaneous connection

Remote connection:

- ◆ 1 VOIP telephone connection = 32K
- ◆ 1 video conference = 128K
- ◆ Internet connection

160K+ bps

Hub station

- ◆ 16 VOIP telephone connection = 512K
- ◆ 10 video multicast transmission = 1280K
- ◆ Internet connection = 512K

2280K+ bps



Considerable issues

- ◆ DVB-RCS bandwidth flexibility
 - Capability in bandwidth allocation
 - Scalability in bandwidth utilization
- ◆ Technology used in IDU
 - Access method to communication
- ◆ Future Enhancement readiness
 - For broadband capability
- ◆ World wide share for practical use
 - Share inside the market



Technology used in IDU: TDMA, FDMA, FTDMA

- ◆ Time Division Multiple Access
- ◆ Frequency Division Multiple Access
- ◆ Frequency and Time Division Multiple Access

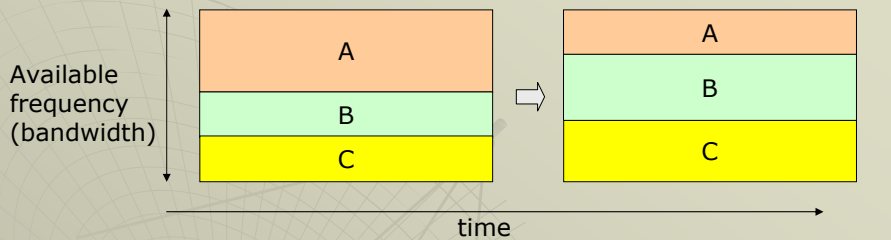
FTDMA >> TDMA , FDMA



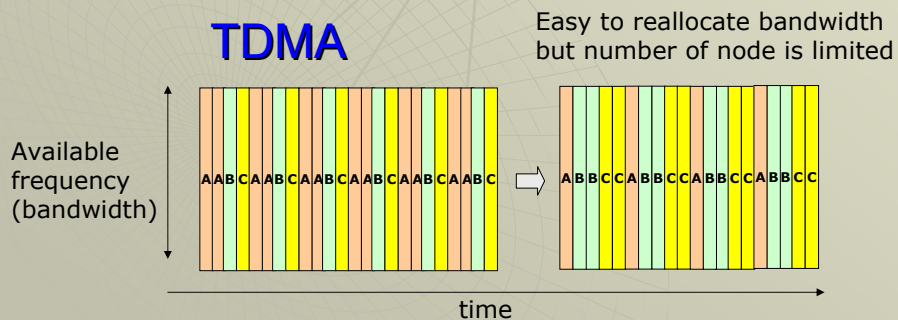
For Maximum efficiency in frequency bandwidth in satellites
FTDMA is the best solution

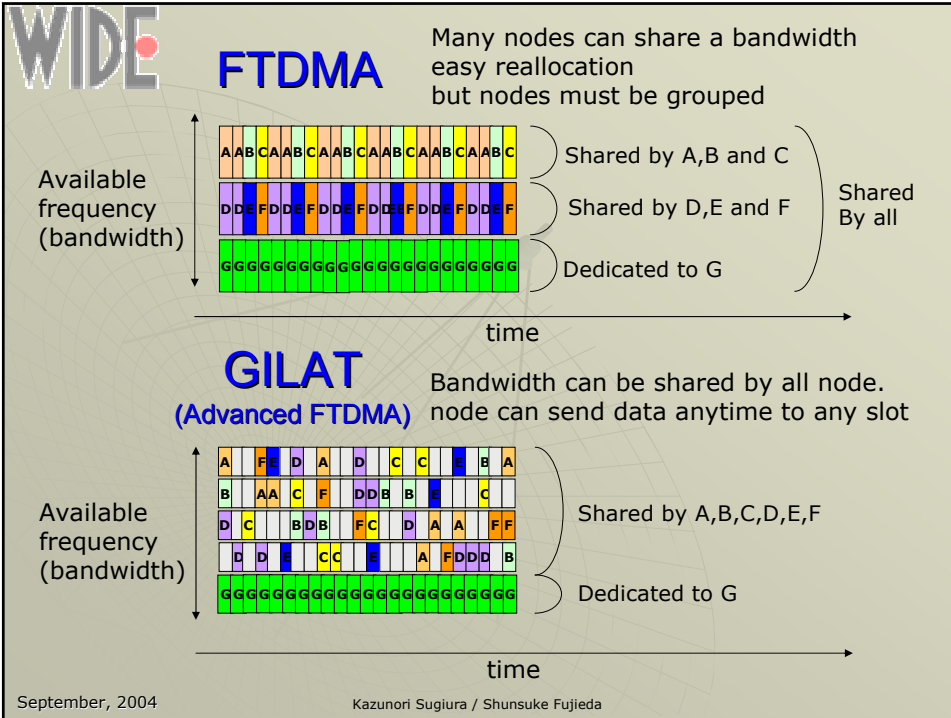


FDMA



TDMA





FINAL CANDIDATE

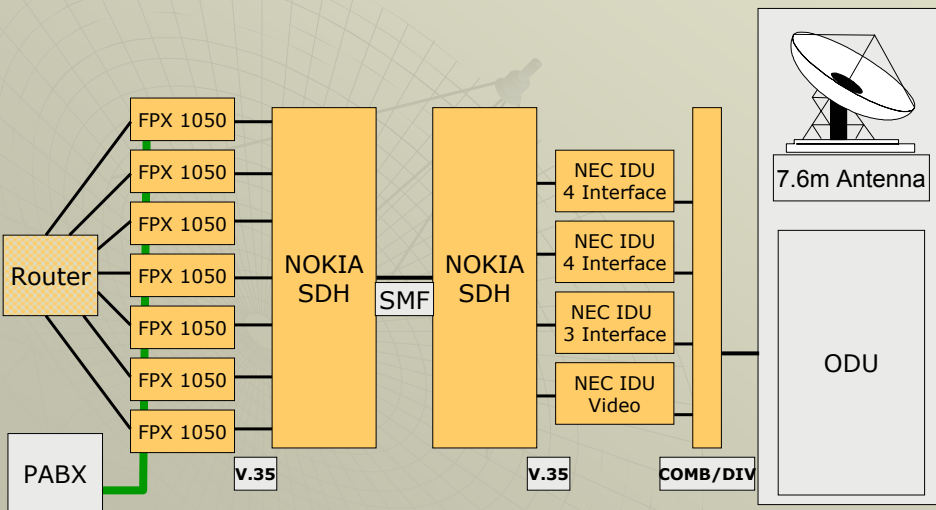
- ◆ GILAT
 - ◆ Advanced FTDMA based infrastructure
 - For optimized frequency utilization
 - ◆ Outgoing, incoming bandwidth flexibility
 - For future enhancement in satellite frequency
 - ◆ High shares
 - Among other competitive
 - ◆ Support availability
 - Future upgrade capability in firmware (IDU)
 - ◆ Cost efficiency
 - Low cost IDU
 - IP readiness

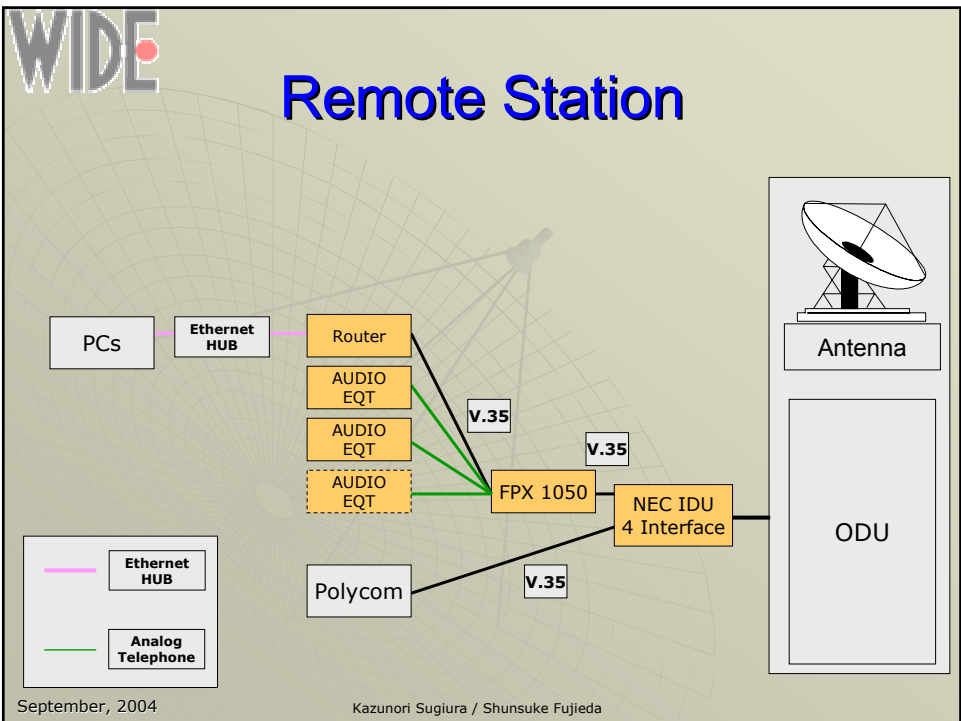
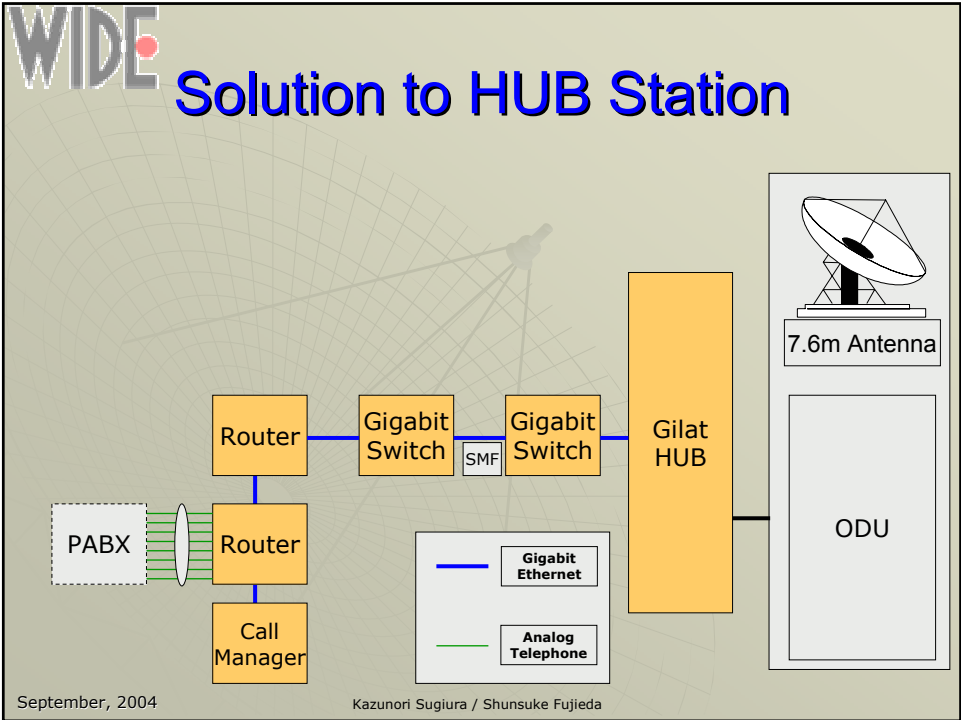
Choosing Gilat is the best answer

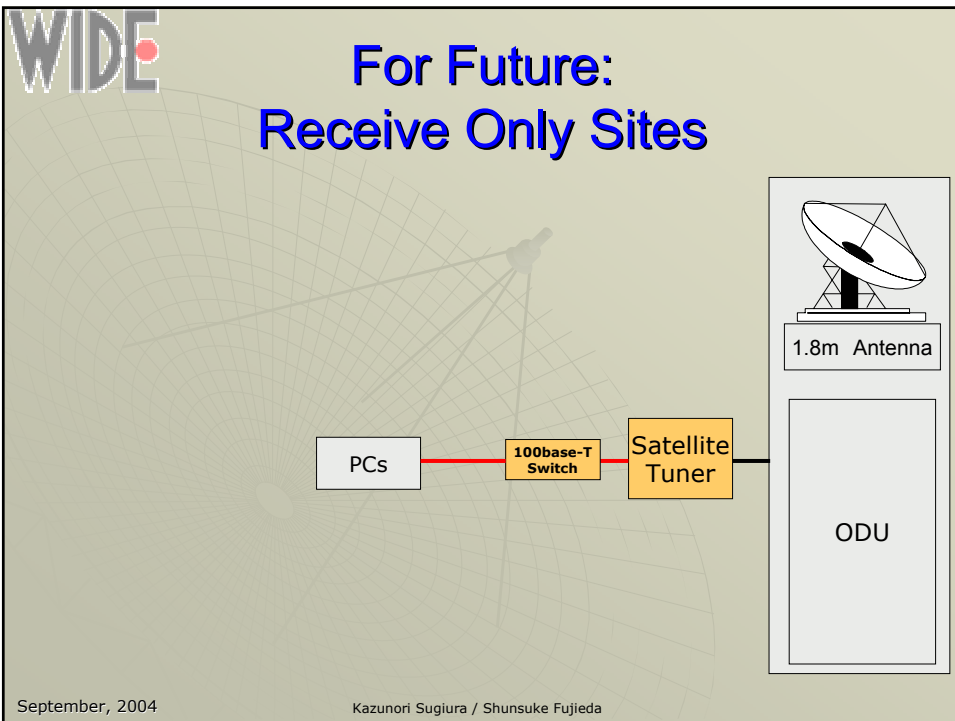
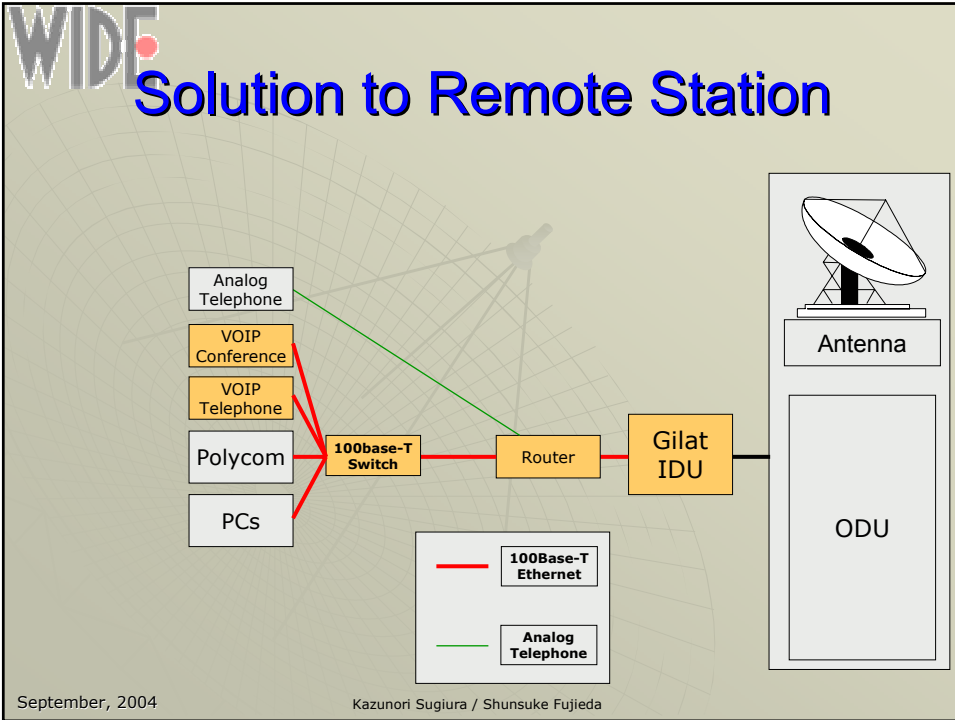
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Replacement Tactics

HUB Station



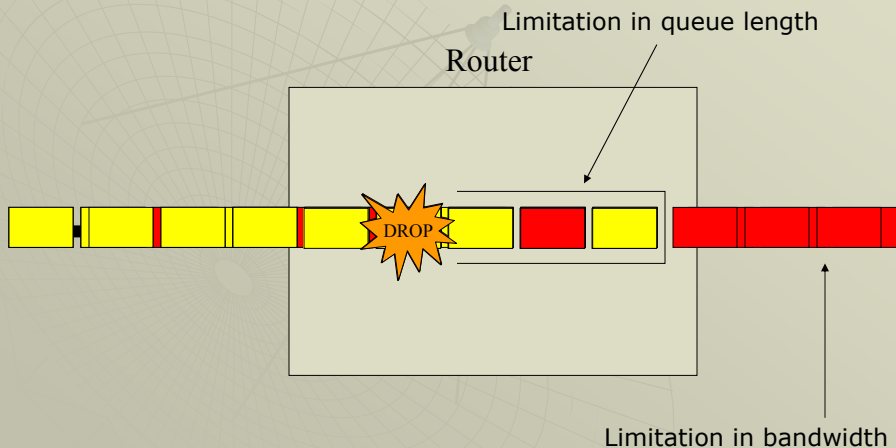




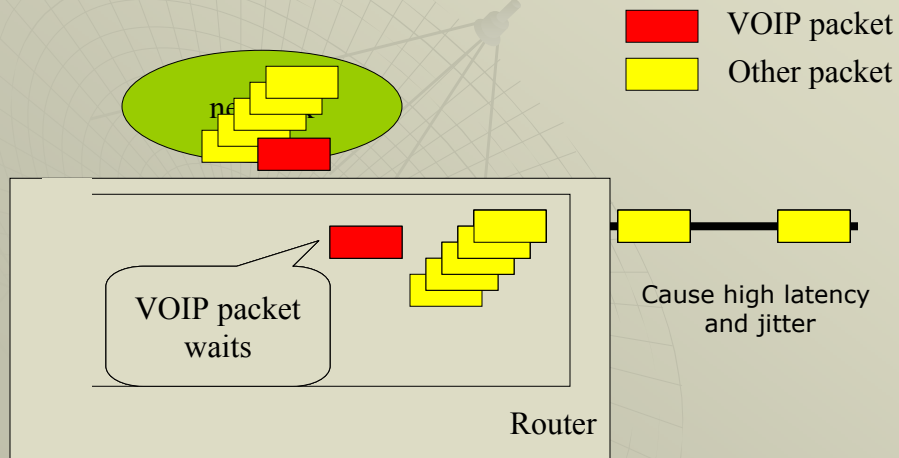
New Technology Installation

- ◆ Association of technology requirement
 - Combination of technology
 - ◆ Multicast technology
 - ◆ VOIP technology
 - ◆ Packet scheduling technology
 - ◆ Video conference tools
 - Bandwidth allocation can be changed easily
- ◆ Stability
 - Simple network
 - Easy to maintenance

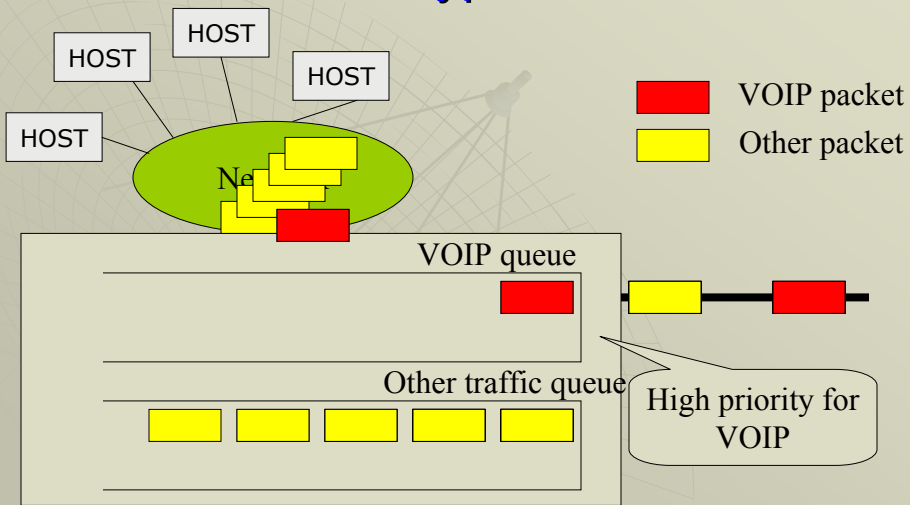
Why We Need Packet Prioritizing?



Packet Timeout with High Queue

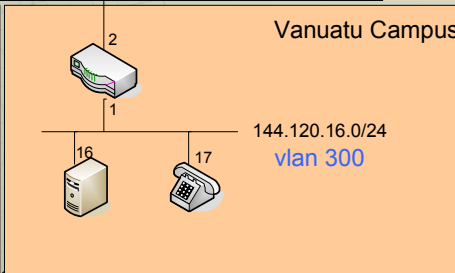
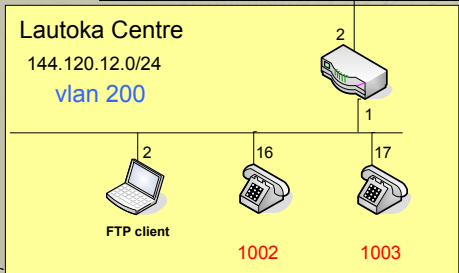
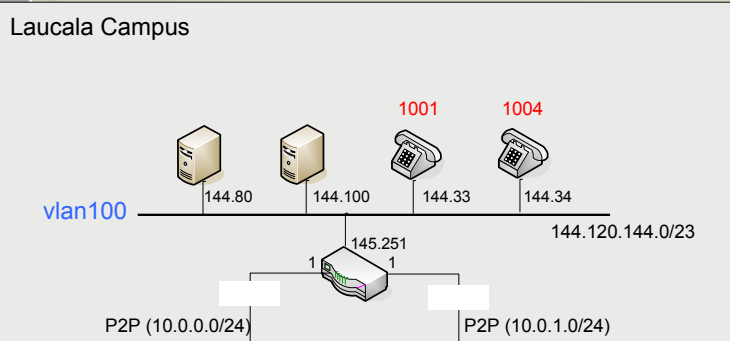


Packet Prioritize Based on Type





VOIP Test Topology Map 2004/08/24, Suva



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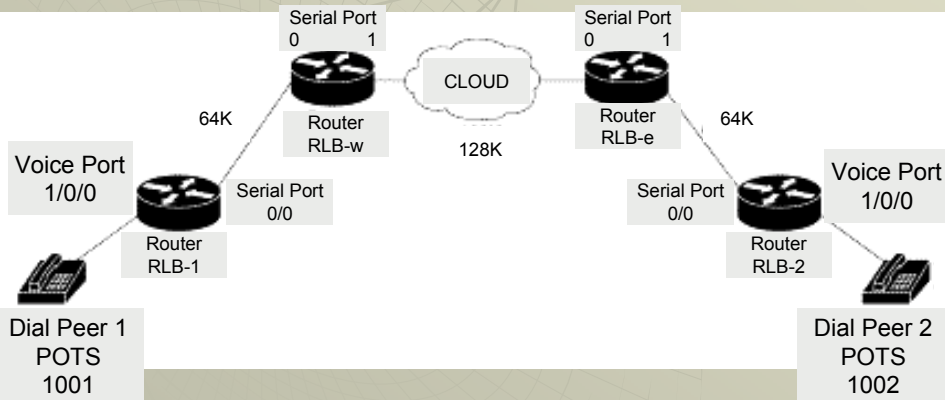


Configuration Samples of VOIP and Routers

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Connecting Analog Phone to Router



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Router Configuration

RLB-1

```
hostname RLB-1
dial-peer voice 2 voip

destination-pattern 1002
req-qos controlled-load

dial-peer voice 1 pots
destination-pattern 1001
port 1/0/0

interface serial 0/0
ip address 10.0.0.1 255.0.0.0
no ip mroute-cache
ip rtp header-compression
ip rsvp bandwidth 24 24
fair-queue 64 256 36
clockrate 64000

router igrp 888
network 10.0.0.0
network 20.0.0.0
network 40.0.0.0
```

RLB-w

```
hostname RLB-w

interface serial 0/0
ip address 10.0.0.2 255.0.0.0

ip rtp header-compression

ip rsvp bandwidth 48 48
fair-queue 64 256 3

interface serial 0/1
ip address 20.0.0.1 255.0.0.0
ip rtp header-compression
ip rsvp bandwidth 48 48
fair-queue 64 256 3

router igrp 888
network 10.0.0.0
network 20.0.0.0
network 40.0.0.0
```

RLB-e

```
hostname RLB-e

interface serial 0/0
ip address 40.0.0.2 255.0.0.0

ip rtp header-compression

ip rsvp bandwidth 48 48
fair-queue 64 256 3

interface serial 0/1
ip address 20.0.0.2 255.0.0.0
ip rtp header-compression
ip rsvp bandwidth 48 48
fair-queue 64 256 3

router igrp 888
network 10.0.0.0
network 20.0.0.0
network 40.0.0.0
```

RLB-2

```
hostname RLB-2
dial-peer voice 2 pots

destination-pattern 1002
port 1/0/0
req-qos controlled-load

dial-peer voice 1 voip
destination-pattern 1001

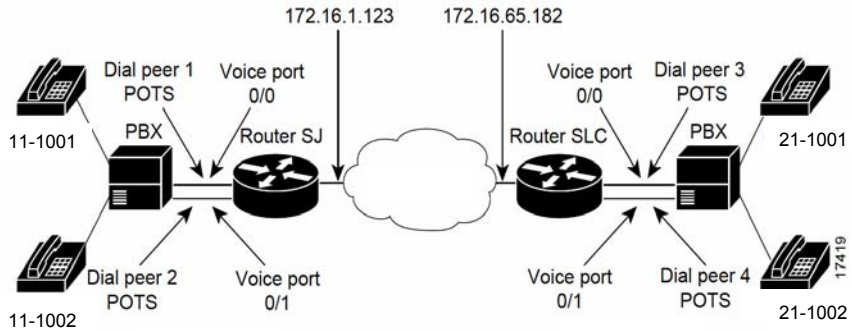
interface serial 0/0
ip address 40.0.0.1 255.0.0.0
no ip mroute-cache
ip rtp header-compression
ip rsvp bandwidth 48 48
fair-queue 64 256 36
clockrate 64000

router igrp 888
network 10.0.0.0
network 20.0.0.0
network 40.0.0.0
```

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Connecting PBX to Router



Router Configuration

```
hostname router SJ
dial-peer voice 1 pots
destination-pattern 11....
port 0/0

dial-peer voice 2 pots
destination-pattern 11....
port 0/1

dial-peer voice 3 voip
destination-pattern 11....
session target ipv4:172.16.65.182
ip precedence 5

voice-port 0/0
signal immediate
operation 4-wire
type 2

voice-port 0/1
signal immediate
operation 4-wire
type 2

interface serial0
ip address 172.16.1.123
no shutdown
```

```
hostname router SLC
dial-peer voice 3 pots
destination-pattern 21....
port 0/0

dial-peer voice 4 pots
destination-pattern 21....
port 0/1

dial-peer voice 1 voip
destination-pattern 21....
session target ipv4:172.16.1.123
ip precedence 5

voice-port 0/0
signal immediate
operation 4-wire
type 2

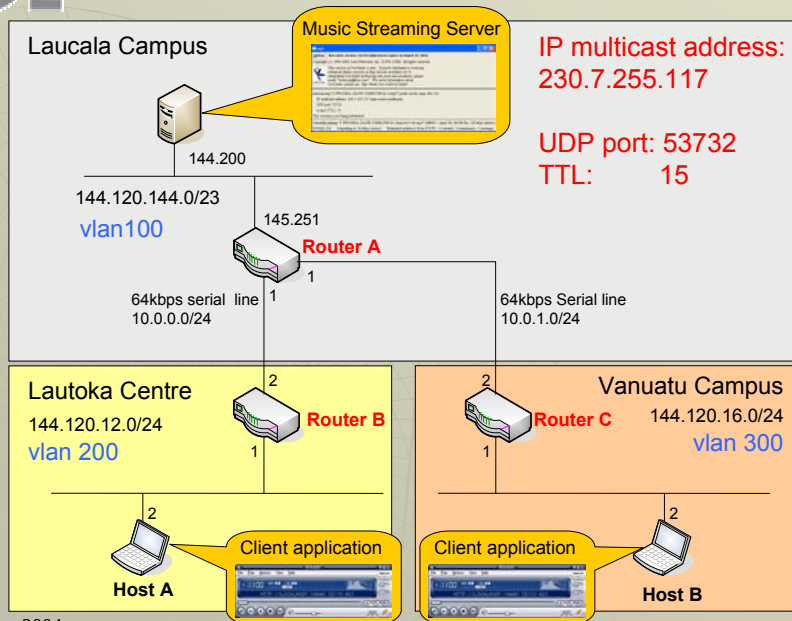
voice-port 0/1
signal immediate
operation 4-wire
type 2

interface serial0
ip address 172.16.65.182
no shutdown
```

IP Multicast

- ◆ Enables channel (group) based communication
 - Reduces traffics
 - ◆ Aggregated way of communication

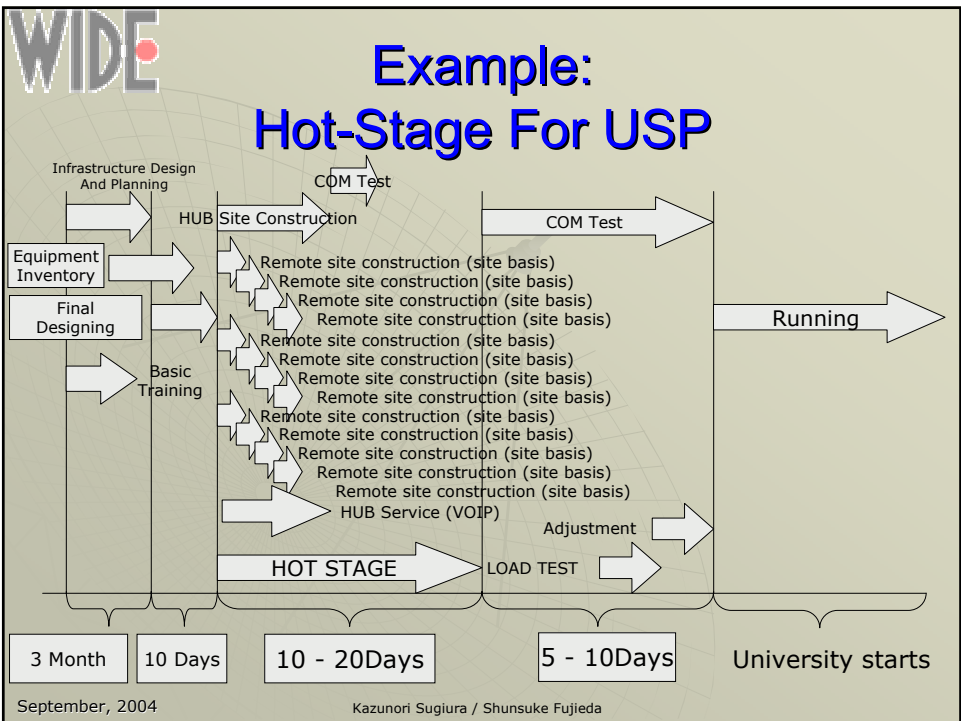
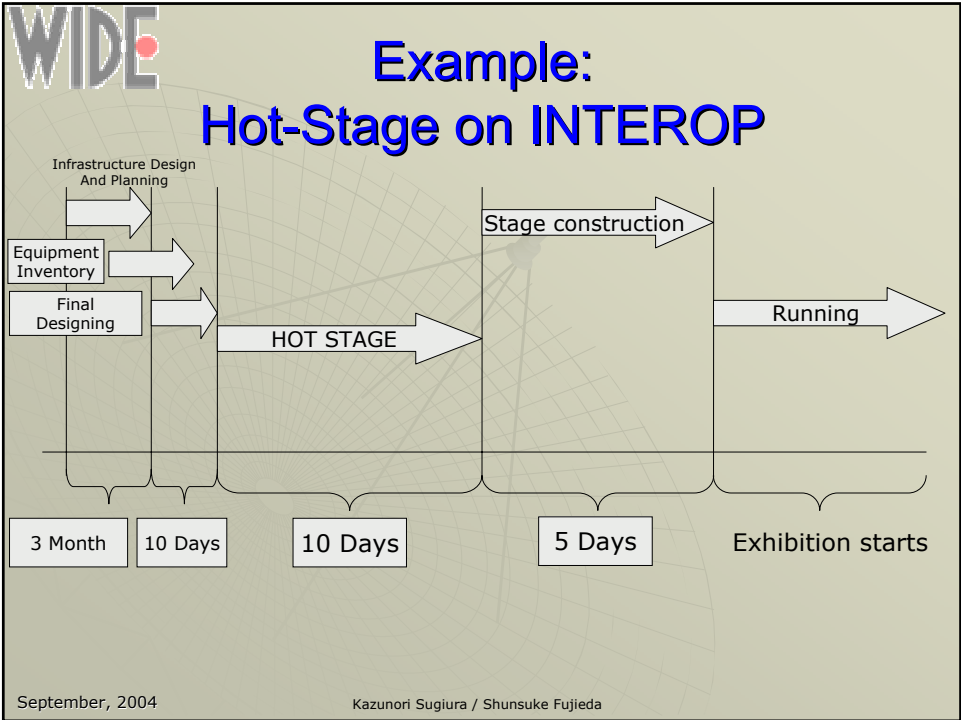
Multicast Test Topology Map 2004/08/30, Suva



Milestones

Practical Ways of Upgrading

- ◆ Hot-stage planning
 - Construct an infrastructure inside the room
 - ◆ Actual connection
 - Emulated connection
 - ◆ Satellite link via cross serial cable
- VOIP design
 - ◆ Dialing plans
 - Combining current PBX
- Actual construction during closing of the university



Resources

- ◆ Resources (Equipment)
 - ◆ Satellite equipment
 - Gilat system (HUB + remote station upgrade)
 - ◆ 6 additional routers (IP upgrade)
 - 6 already bought by JICA
 - Additional Ethernet switches
 - VOIP terminals, conference systems
- ◆ Resources (Human)
 - Leader[1 (+1)]
 - ◆ Technical advisor
 - Total coordinator (1-2)
 - ◆ CISCO advisor(1)
 - ◆ Gilat advisor(1)

Conclusions

- ◆ There will be revolution:
 - IP based infrastructure
 - ◆ Communication infrastructure
 - ◆ Intellectual activities



For LOOONG term Solution

- ◆ Consideration of ICT Building

 - Digital Media archive service

 - CD Quality audio (1.5Mbps)

 - DVD Quality Video (10Mbps)

 - SD Quality Video (30Mbps)

 - Media conversion

 - Real-time MPEG4 stream conversion

 - ◆ To remote campus

 - IX (Internet Exchange)

 - Possible?

 - Research on Islanded Internet infrastructure