Distribution

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Code : STM230

IP Telephony Network Design

Customer Training Center

Enterprise IP Solutions
OfficeServ

Enterprise IP Solutions
OfficeServ 7400

Samsung Electronics Co., Ltd.

Objectives

- **After successful completion of the course the trainees should be able to execute the following activities.**
  - To understand basic network design for IP Telephony.
  - To suggest a optimized network design according to the VoIP system usage and its network status.
  - To trace down the VoIP quality problems occurred in VoIP system.

Contents

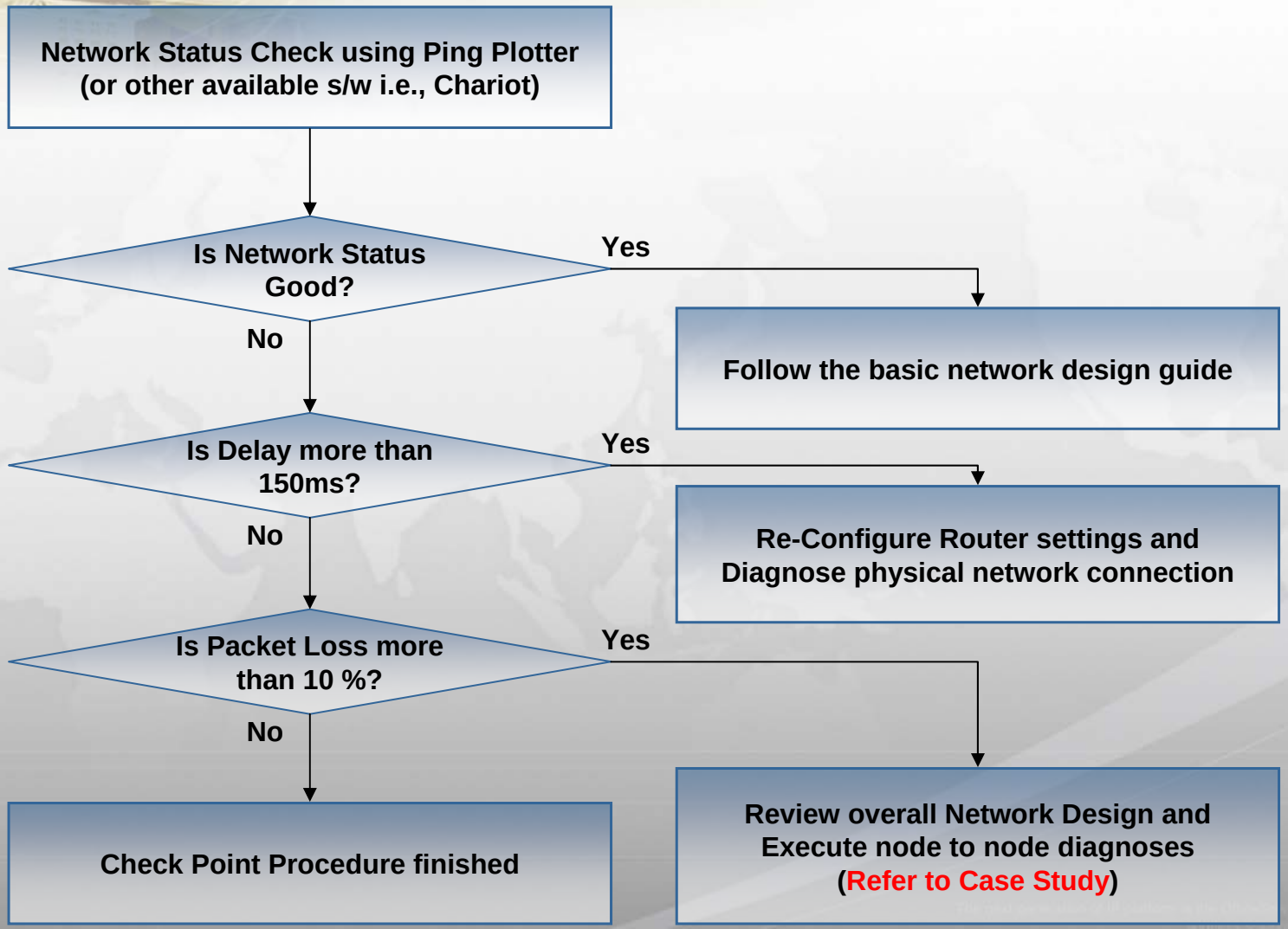
- *Introduction to Network Design*
- *Basic Network Design Guidelines*
- *Case Study*

Introduction to Network Design

Overview

- Network Design for VoIP system is different from general network design in that it focuses more on efficient RTP packet transmission than Data packet.
- Voice quality is significantly affected by how much network design is optimized to the VoIP system use and its network status.
- Having a proper network design is a essential and prerequisite for a successful VoIP system.

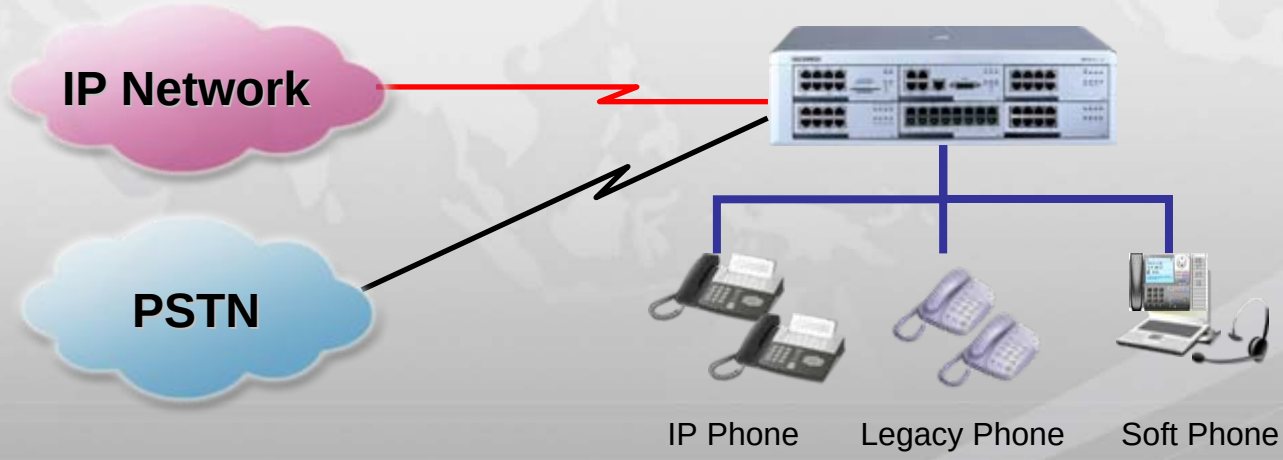
Network Check Point Procedure



Basic Network Design Guidelines

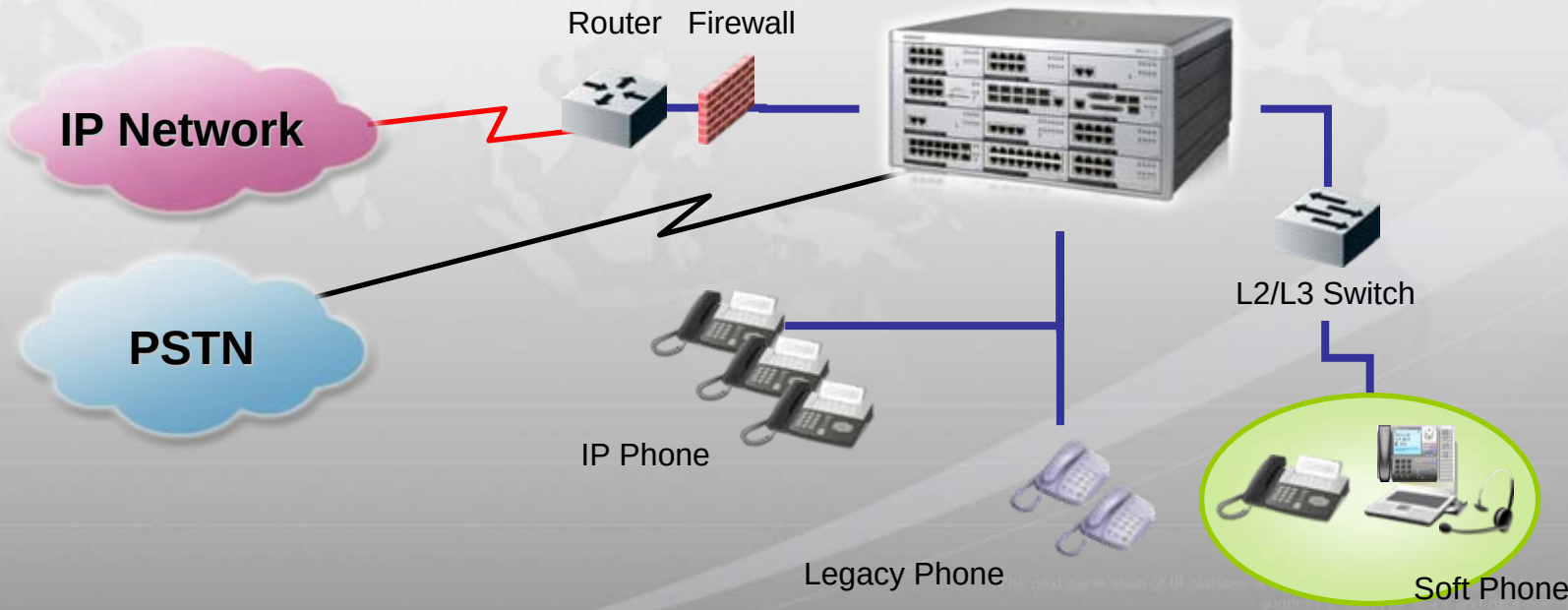
Basic Stand-Alone System

- **Basic Stand-Alone System with no Legacy**
  - Hosts a small number of VoIP users. (20-50).
  - Suitable for Newly constructed VoIP system with which no legacy system is inter-operated.



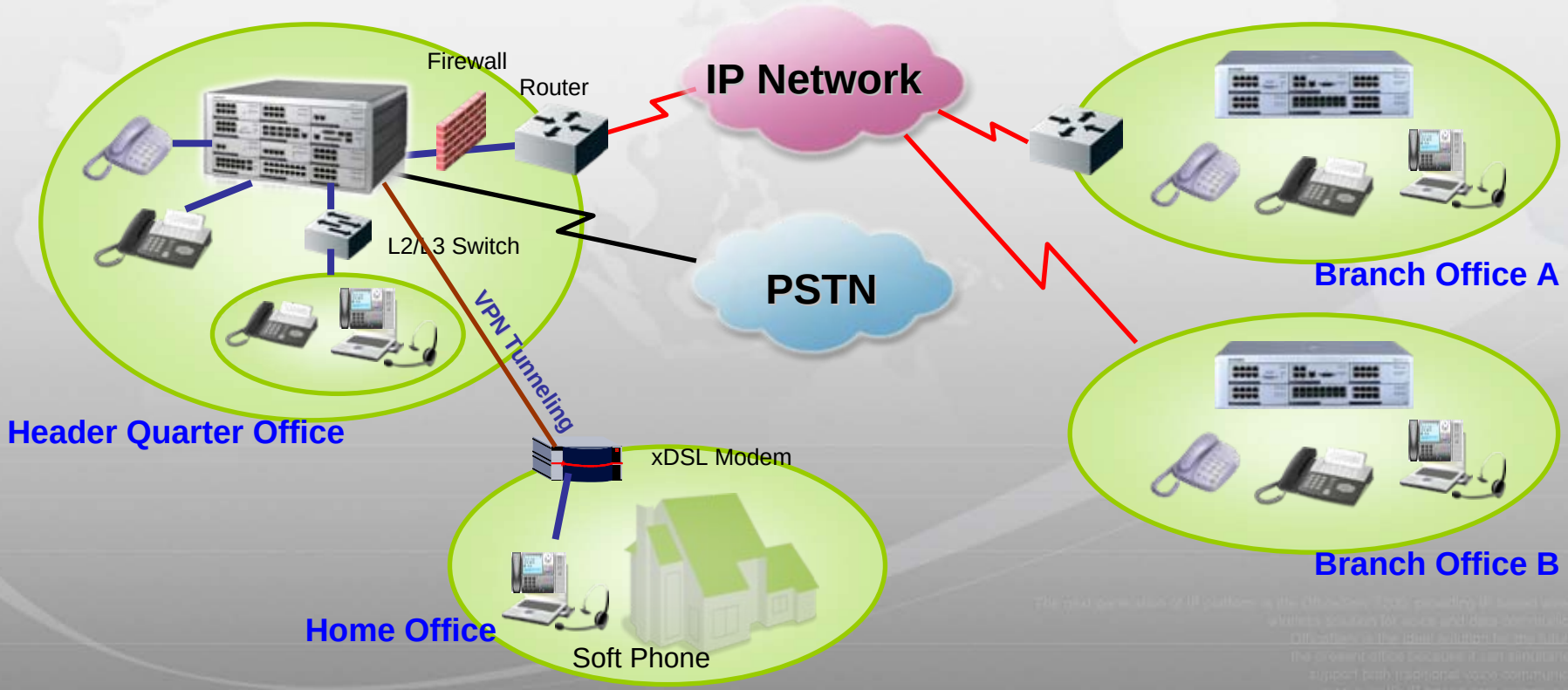
Basic Stand-Alone System

- **Basic Stand-Alone System with Legacy**
  - Hosts a small number of VoIP users. (20-50).
  - Suitable for VoIP system having legacy system inter-operated with.
  - IP Phone under local network uses Media Gateway to send/receive RTP packets.



HQ-Branch Office System

- **VoIP system in HQ-Branch Office Configuration**
  - Suggested for a middle sized or bigger VoIP system.
  - Hosts a large number of VoIP users. (50 or more).
  - VoIP and Data packets are transferred over WAN.

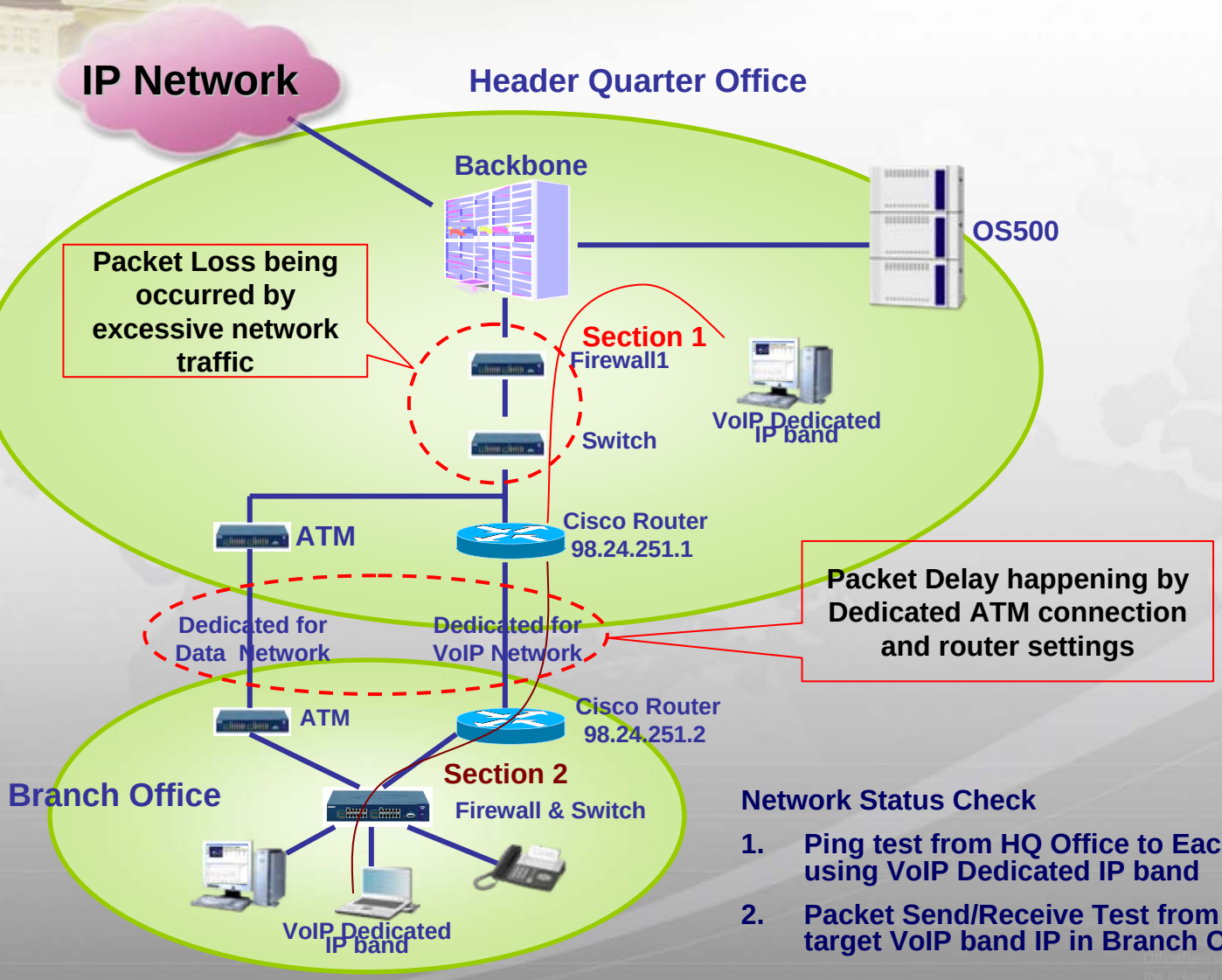


Case Study

Problem Types

Category	Cause	After Network re-Design
Packet Loss	• More than 10% of Packet loss which normally lasts for seconds • Packet loss between backbone and router within HQ office detected • Occasional over traffic caused by excessive network connection degraded system performance	• Packet loss decreased to almost 0 % from 10 % • Re-design network configuration so that network packet can be directly handled by the Router • Solved looping problem caused by duplicated backbone • Solved traffic problem happened by garbage data from internal broadcasting equipments
Packet Delay	• Packet transmission delay between HQ office and Branch office detected	• Packet delay decreased to tens of ms' from seconds • ATM network check done by Korea Telecom • QoS method changed from FIFO to Fair Queue

Original Network Design



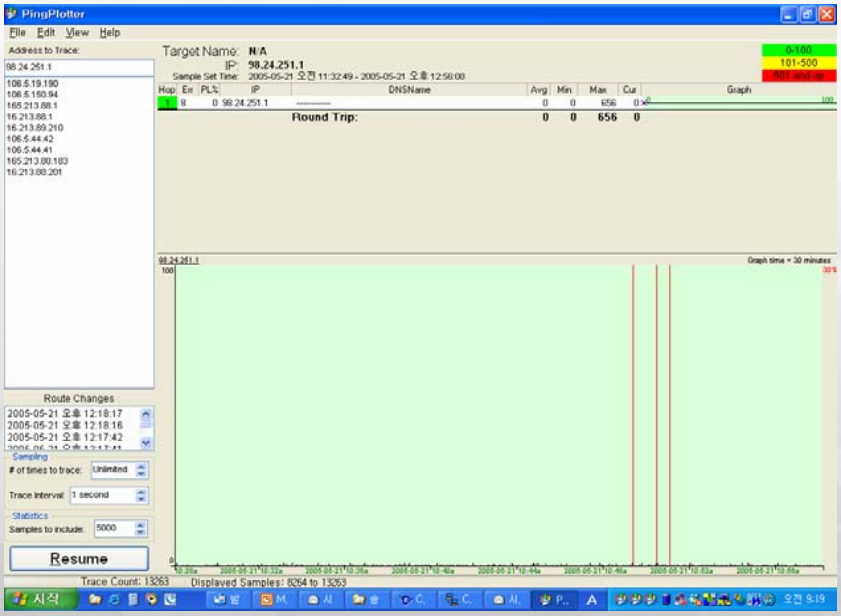
Network Status Check

1. **Ping test from HQ Office to Each Sub Section using VoIP Dedicated IP band**
2. **Packet Send/Receive Test from HQ Office to target VoIP band IP in Branch Office. (Chariot)**

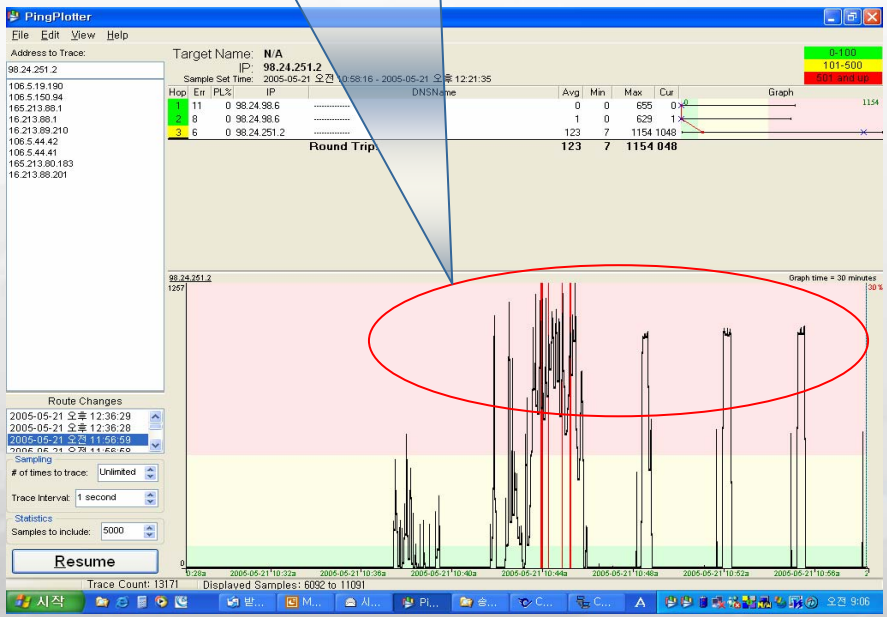
Original Network Design

- **Ping Plotter Test**

Regular Packet Transmission Delay which lasts more than a second



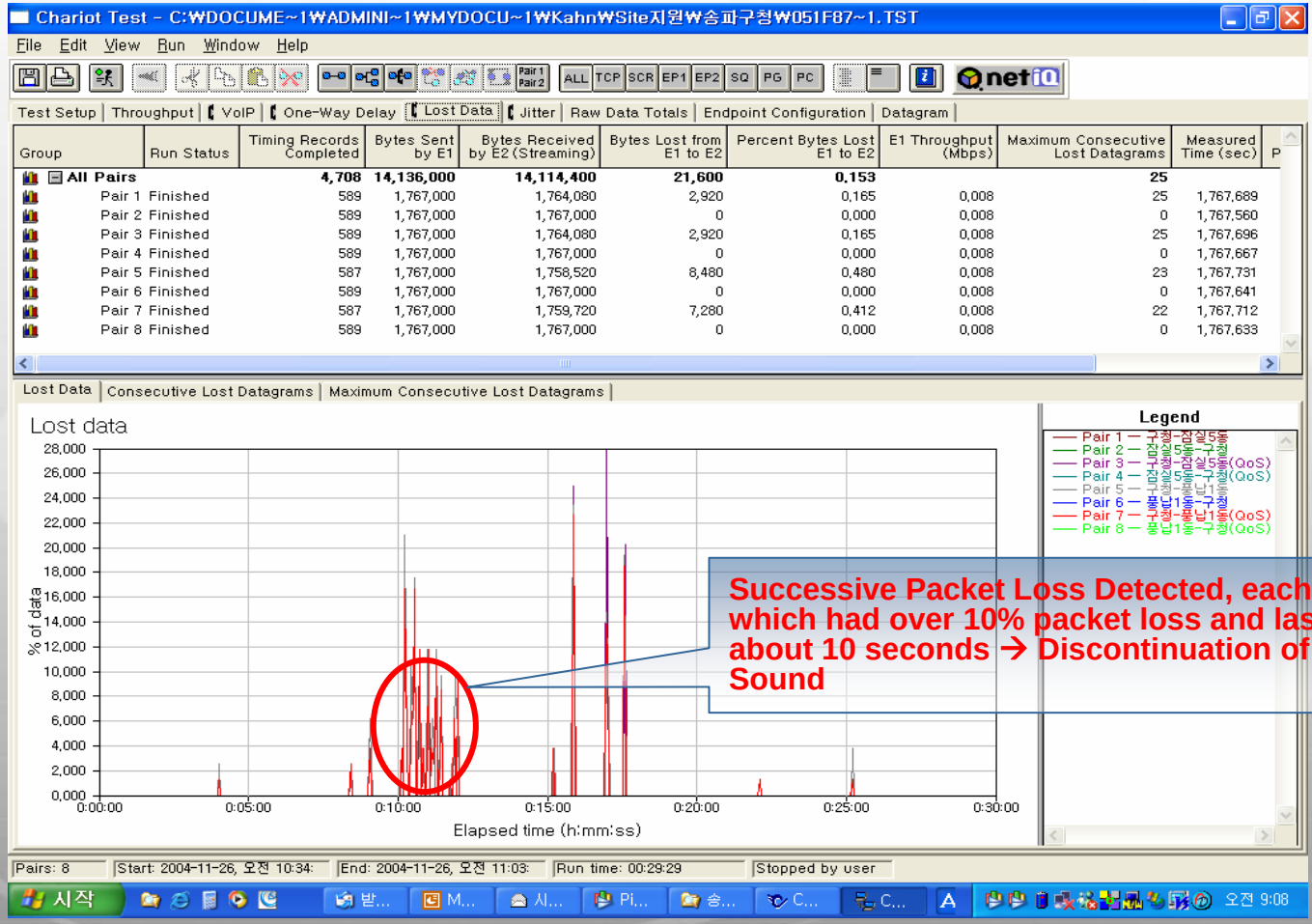
[From Test PC to Router in HQ Office]



[From Test PC to Router in Branch Office]

Original Network Design

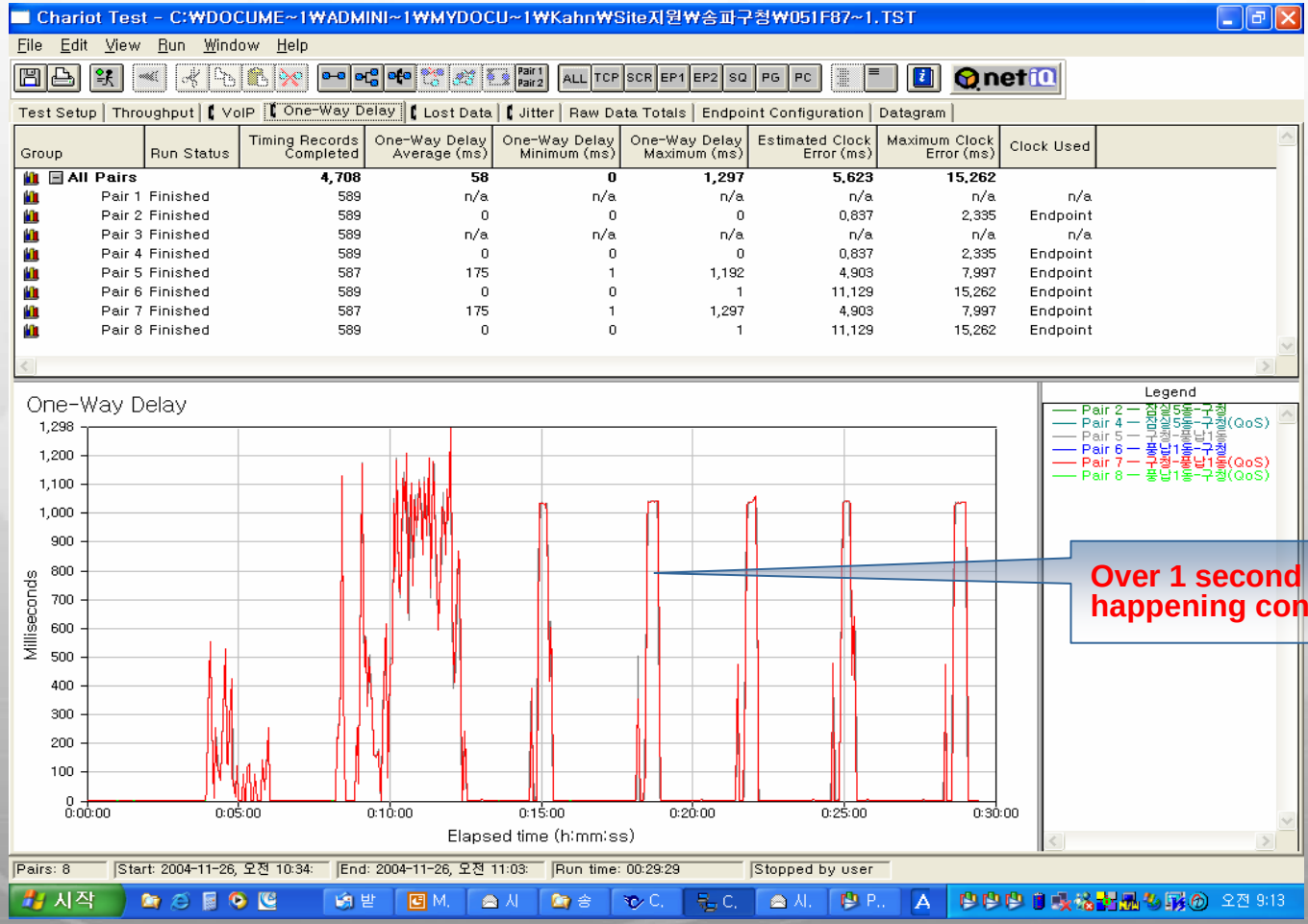
- Chariot Test (Packet Loss)



[From HQ Office to Branch Office]

Original Network Design

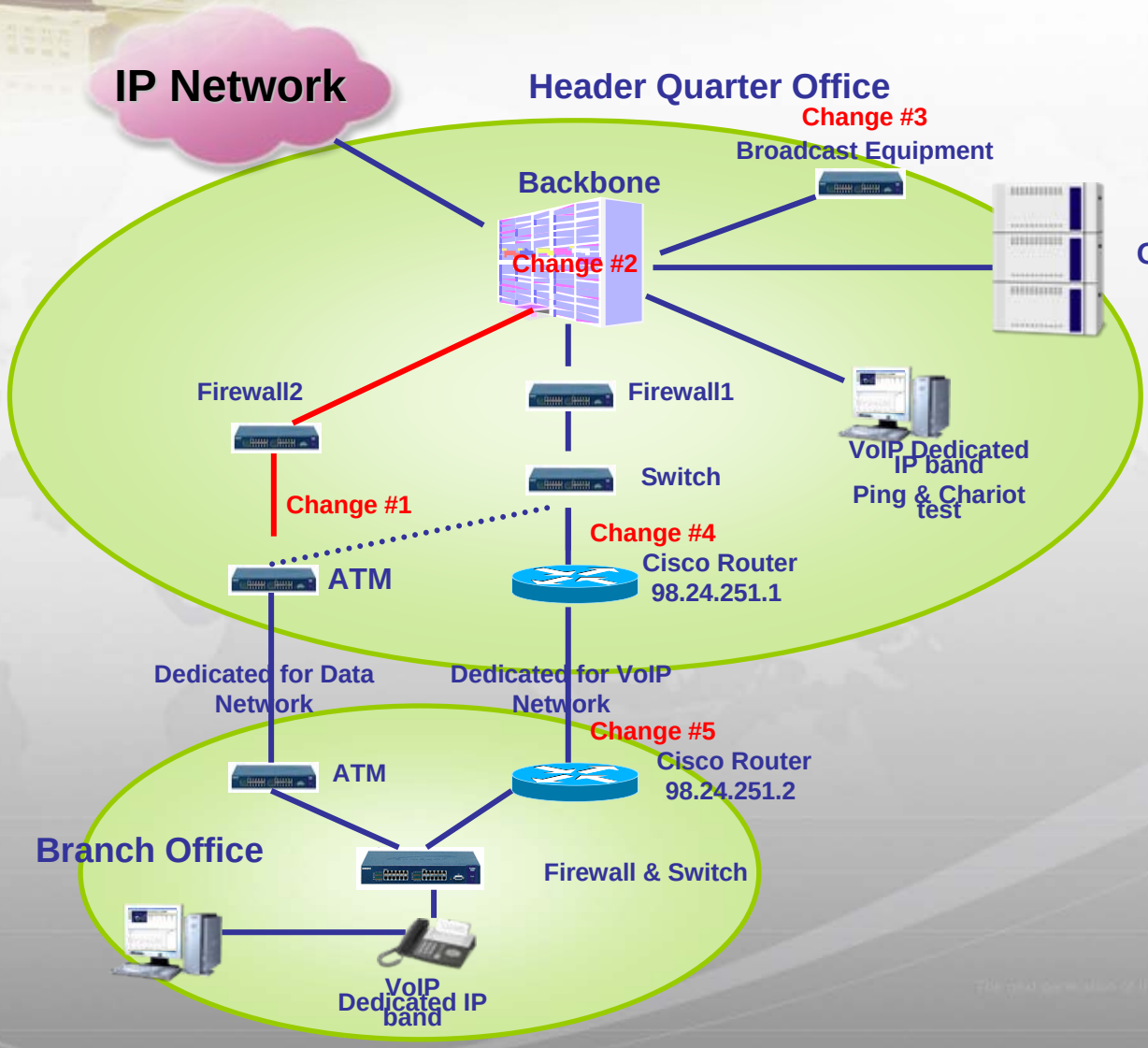
- Chariot Test (Oneway Delay)



Over 1 second Delay happening consecutively

[From HQ Office to Branch Office]

Network Design Change Phase #1

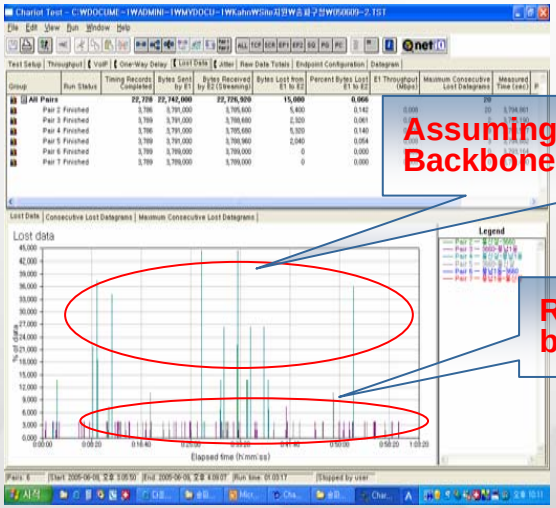


Change List (1~5)

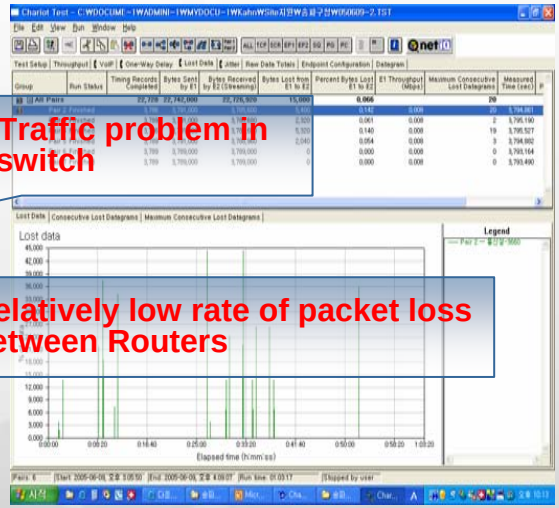
1. Traffic load balancing by Firewall; New Path is marked in RED
2. Loop traffic path change in Backbone
3. Removing unnecessary traffic in broadcast equipment, and change its traffic path to ATM to relieve load in Firewall 1.
4. Change queuing method in router
5. Dedicated physical network line check

Network Design Change Phase #1

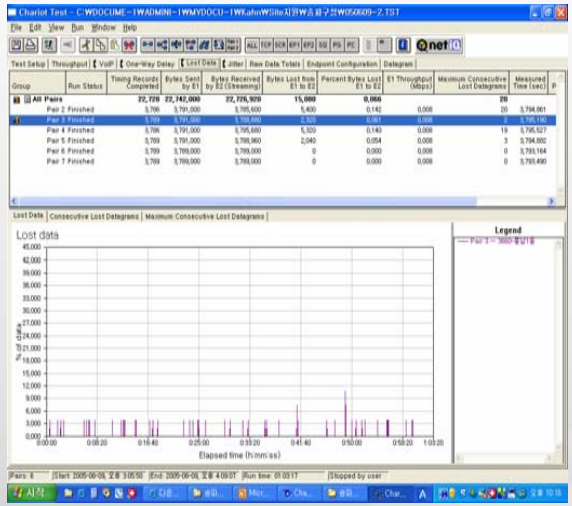
Node-to-Node Packet Loss Test



[From Test PC to PC in Branch Office]



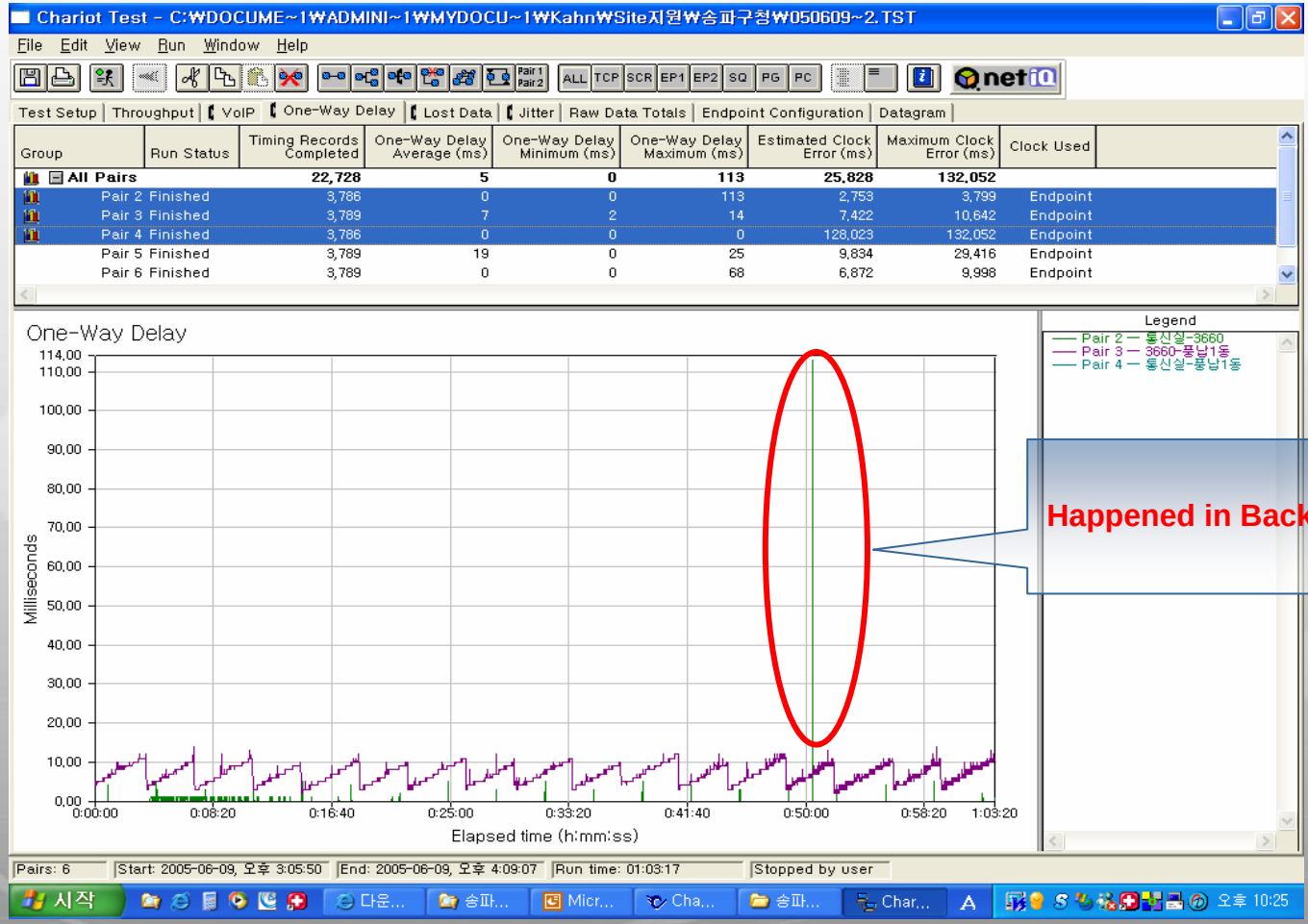
[From Test PC to Router in HQ Office]



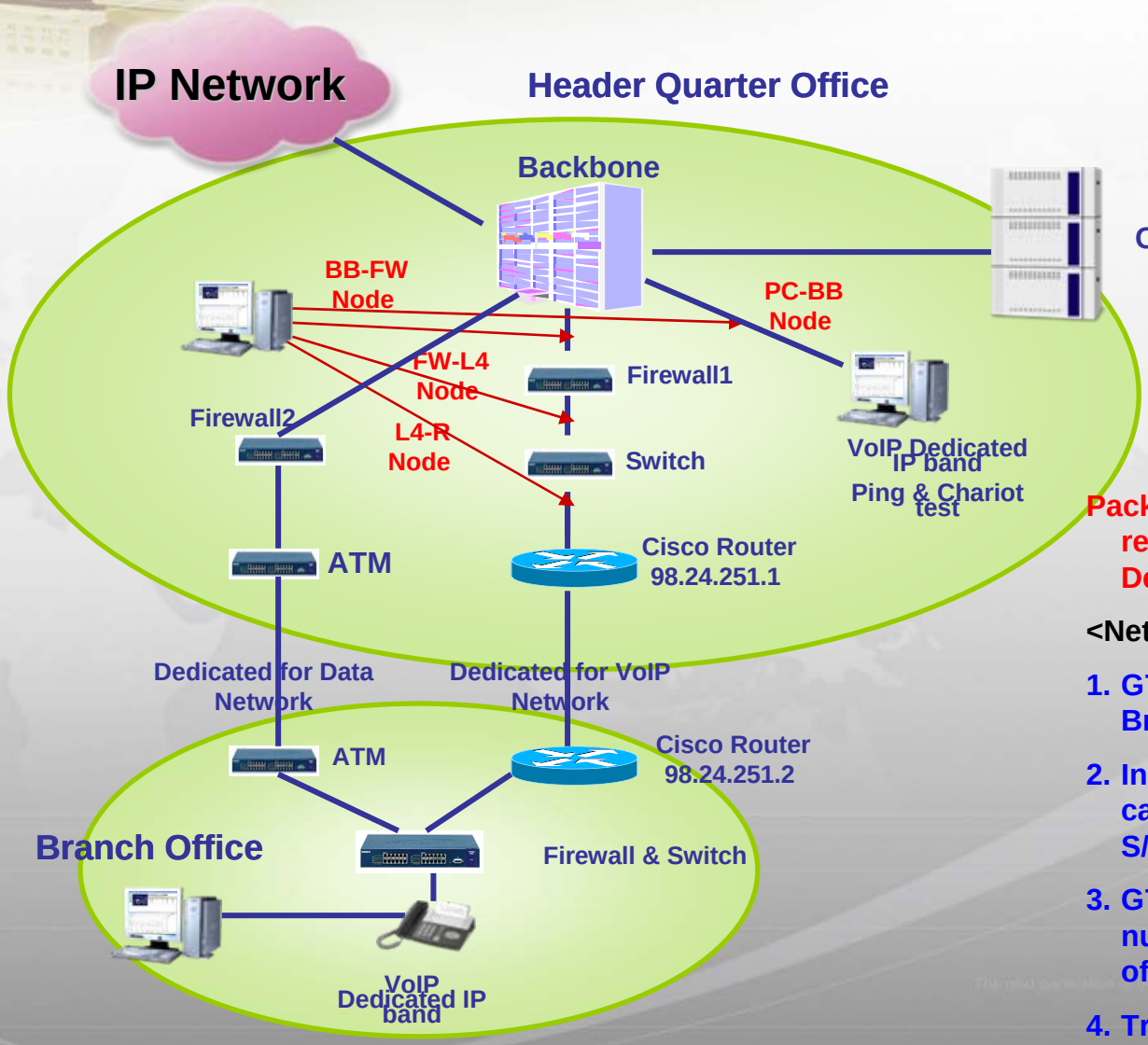
[From Router in HQ to PC in Branch Office]

Network Design Change Phase #1

- Delay check when Packet Loss Decreased



Network Design Change Phase #2



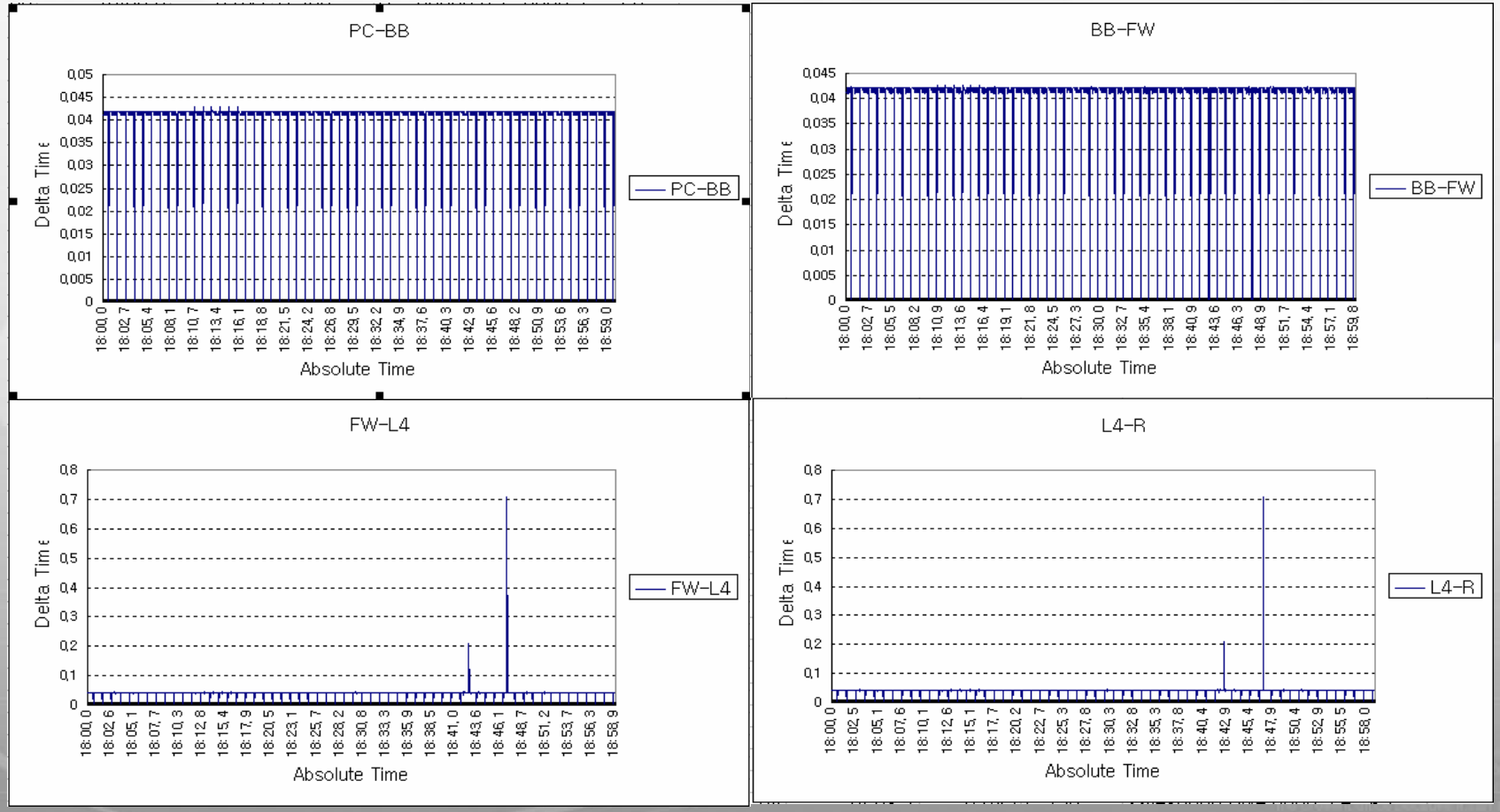
Packet Loss not entirely removed since Network Design Change Phase #1

<Network Test after Phase #1>

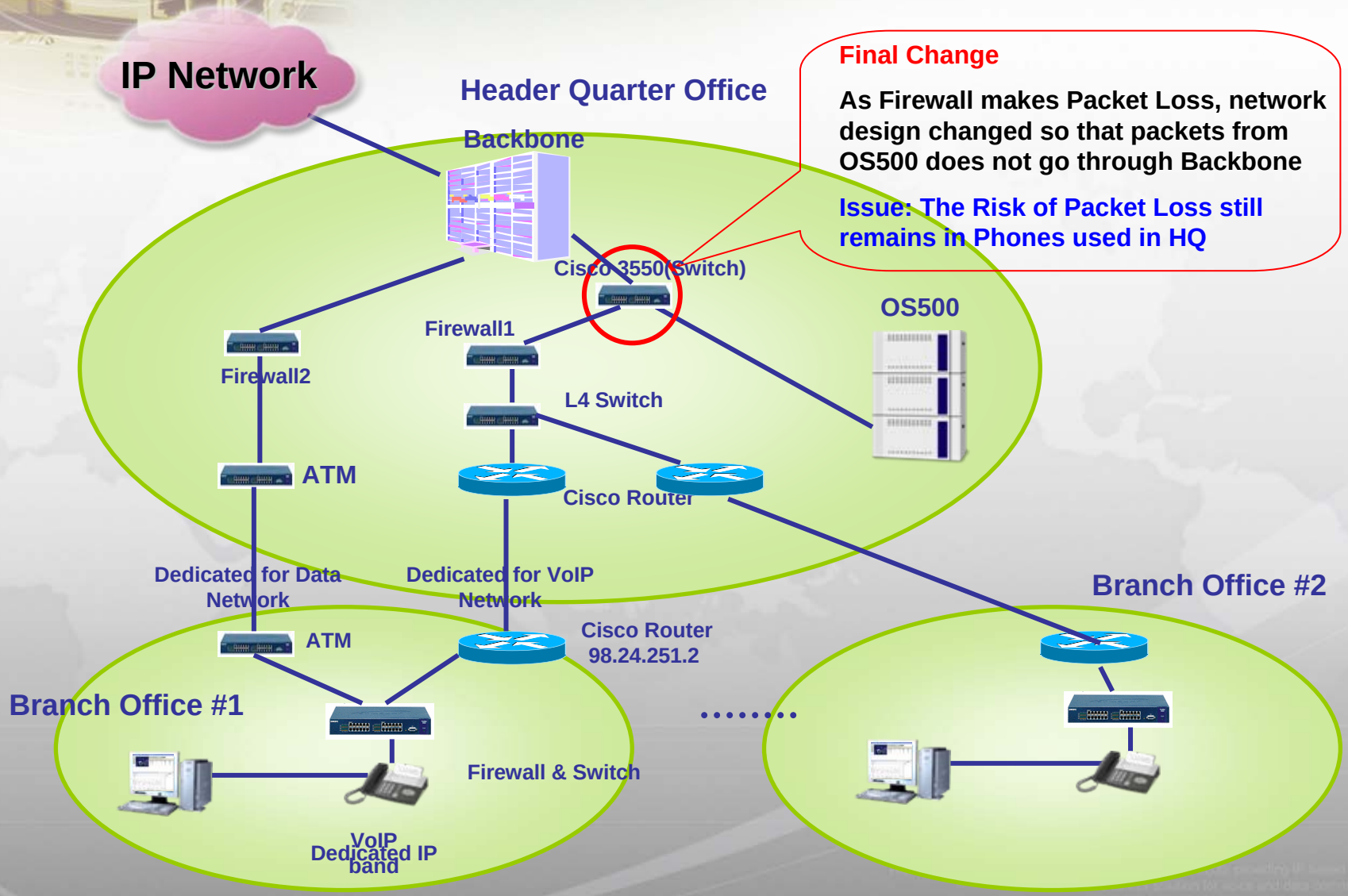
1. G729 packet test from PC to Branch Office
2. In-between node packet captured using OmniPeek S/W installed in test Srv
3. G729 packet's sequence number analysis at the time of packet loss
4. Traffic load analysis before and after the packet loss

Network Design Change Phase #2

- Packet Transmission interval of 40 ms
- Packet Loss happed when going through Firewall
- Switch maintains Packet Transmission interval



Network Design Final Phase



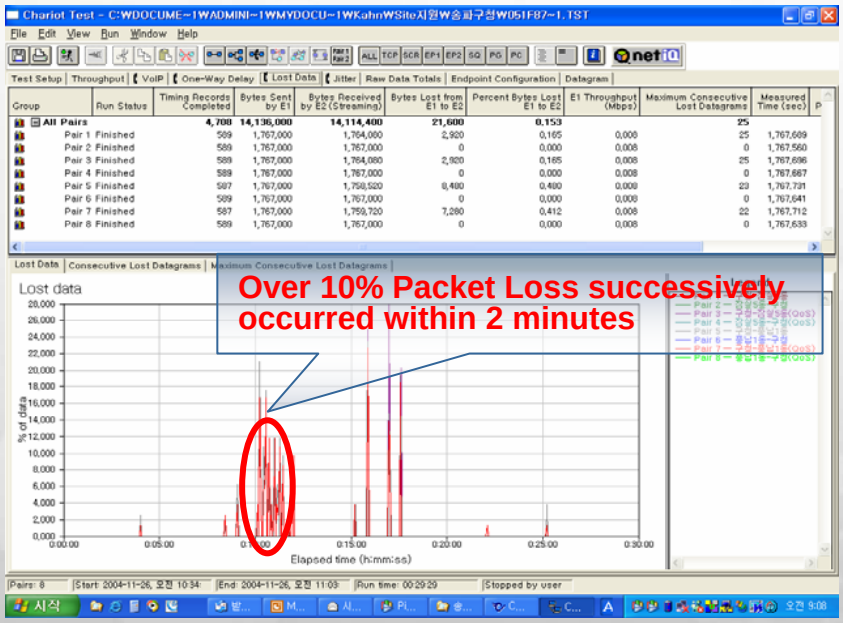
Final Change

As Firewall makes Packet Loss, network design changed so that packets from OS500 does not go through Backbone

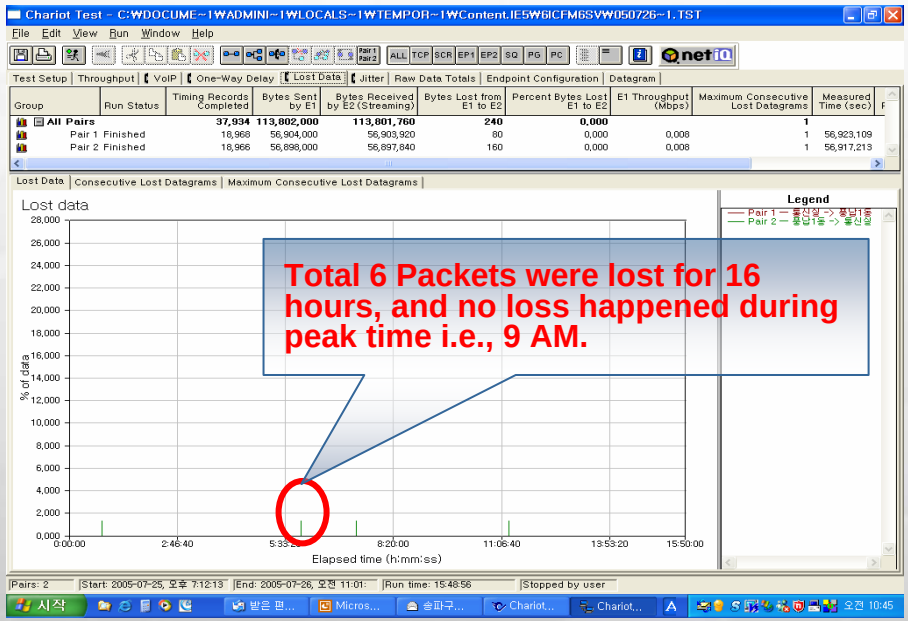
Issue: The Risk of Packet Loss still remains in Phones used in HQ

Network Design Final Phase

- **Packet Loss Test**



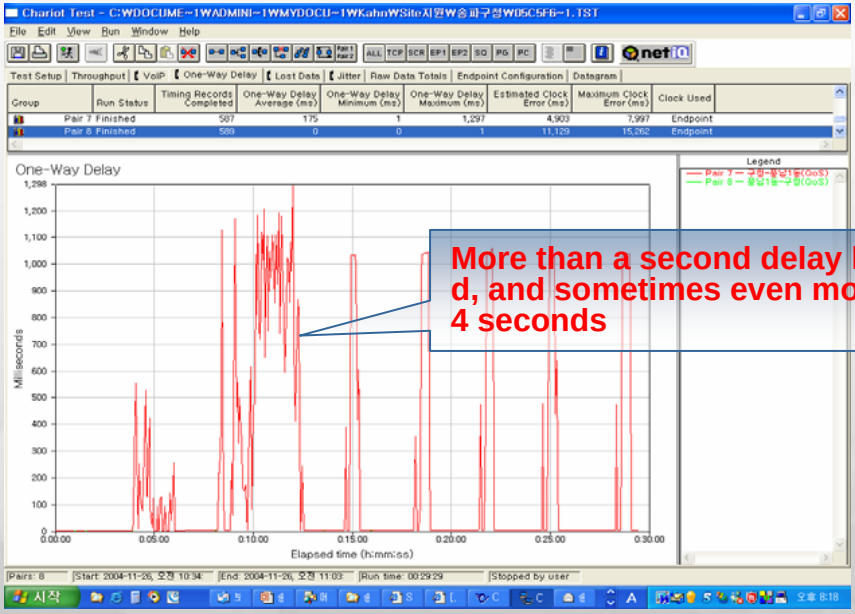
[Before Network re-Design]



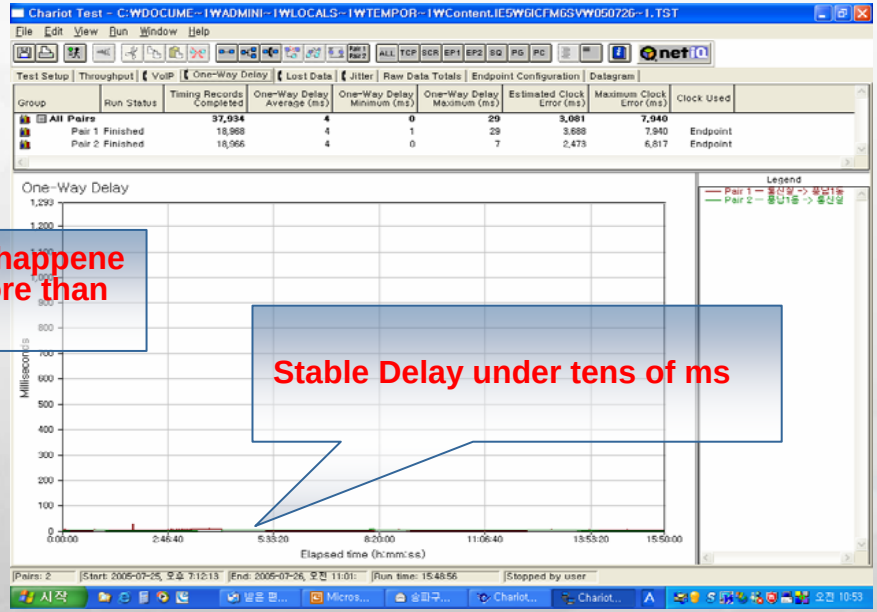
[After Network Design Final Phase]

Network Design Final Phase

- One-way Delay



[Before Network re-Design]



[After Network Design Final Phase]

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Thank you !

The next generation of IP platform is the OfficeServ 7
wireless solution for voice and data communication
OfficeServ is the ideal solution for the future and
the present office because it can simultaneously
support both traditional voice communication,
voice over IP, IP based data communication,
and wireless solutions through Wireless LAN.

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