Utilizing DiffServ and SIP Contact Header for Real-time Fax Traffic Engineering

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BEGINNING

Introduction

- “Voice over IP”, “Fax over IP”
  Replacing the traditional method of delivery of telecom services by PSTN through utilization of data networks (e.g. the Internet)
- Benefits:
  - Saving fortunes
  - Newly-presented capabilities
- Existing implementation problem:
  Data networks have not been designed with telecommunications services in mind: Bursty data

Research Outline

- Research focus:
  Transmission of real-time fax in IP networks
- Adopted architecture:
  The best current practices: Utilization of Session Initiation Protocol (SIP) as the signaling protocol along with ITU-T T.38 Rec.
- Proposed traffic engineering measures:
  - Utilization of SIP Contact Header
  - DiffServ QoS architecture
- Computer simulations are utilized for the analysis:
  - A simplified version of the SIP network components is developed
  - Monitored parameters:
    - Throughput
    - Packets' sequence numbers
    - TCP congestion window

Fax over IP and QoS Architectures

- Fax over Packet Networks:
  - Store-and-Forward Fax over IP Networks-T.37
  - Real-time Internet Fax-T.38 *(Focus of this research)*
- Fax parameters details negotiation requires far more signaling compared to voice; hence the need for high QoS
- QoS architectures:
  IntServ, MPLS/GMPLS, DiffServ *(Selected in this research)*
- DiffServ:
  - Less complicated;
  - Sophisticated classification, marking, policing, and shaping operations ONLY at network boundaries;
  - Per-Hop Behaviors (PHBs):
    Expedited Forwarding (EF), Assured Forwarding (AF), Best Effort (BE)

Call Signaling

- Signaling: session initiation, management and tear-down
- MGCP/H.248/Megaco
  Call control and services could be centrally added to a V/FoIP network
- H.323
  Distributed architecture, Binary, Complex
  Umbrella protocol: Call establishment, Capabilities exchange,
  Network resource availability
- SIP
  Distributed architecture,Text-based, User mobility
  SIP only defines how sessions are to be setup and torn down:
  - SDP for capabilities exchange
  - URLs for addressing
  - Domain Name System (DNS) for service location
  - Telephony Routing over IP (TRIP) for call routing

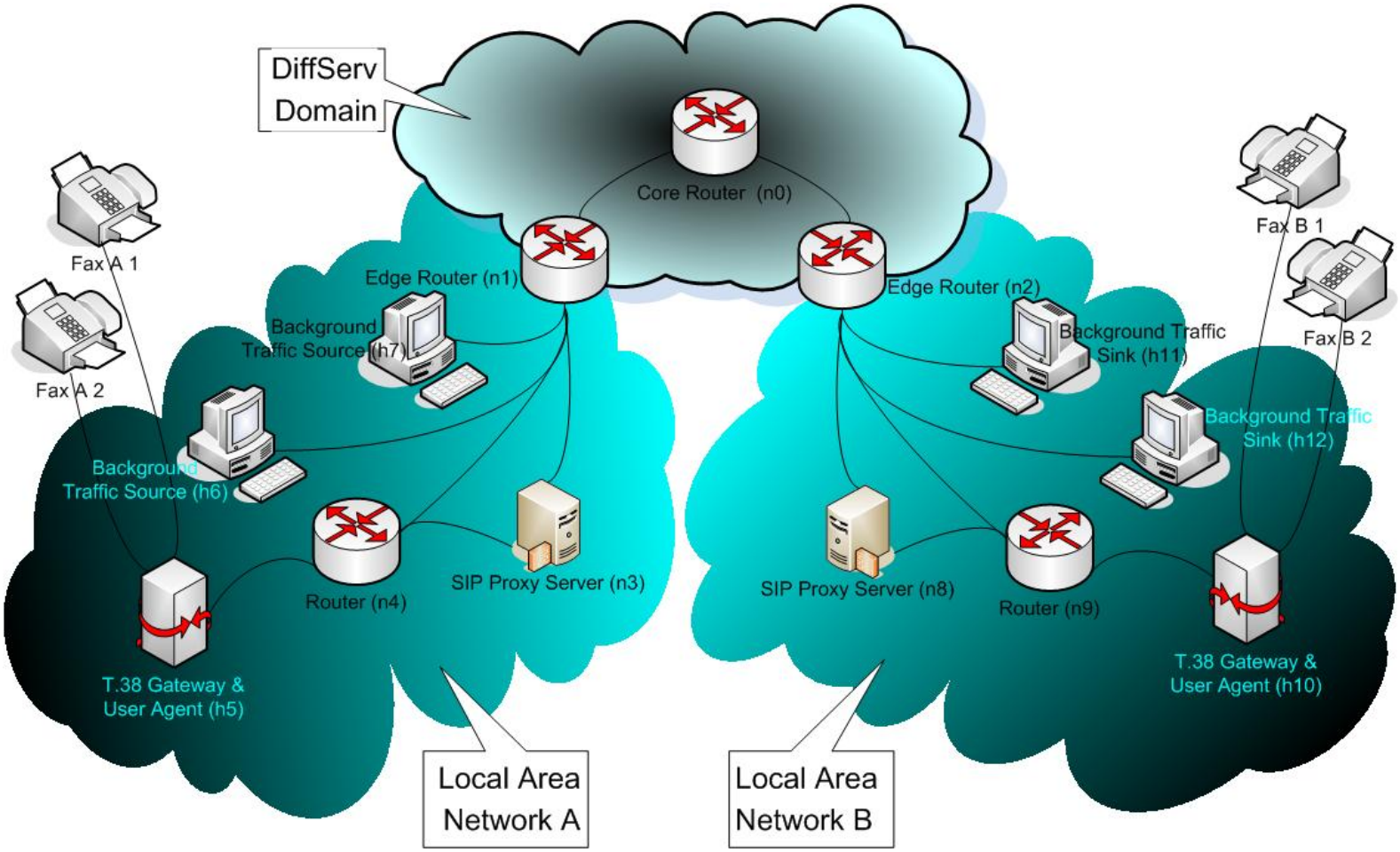
SIP: Session Initiation Protocol

- An application-layer signaling protocol for creating, modifying, and terminating sessions:
  - Applicability to numerous session types
  - Can use either TCP or UDP for transport *(UDP in this research)*
- SIP network components:
  User Agent, Proxy Server, Redirect Server, Registration Server
- Original SIP Requests:
  INVITE, REGISTER, BYE, ACK, CANCEL, and OPTIONS
- SIP headers:
  Header types: general, request, response, and entity
  The set of general headers include the *Contact Header*

Implementation Details

- SIP and T.38 Utilization for FoIP
  The best current practices for SIP T.38 fax sessions are documented in an IETF Internet-Draft
- J-Sim:
  - A powerful Java-based network simulation tool
  - A dual-language (Java & TCL) environment that allows auto-configuration and on-line monitoring
- Developed Modules:
  SIP Message, SDP Message, SIP Proxy Server, SIP User Agent, and T.38 modules
- Specific T.38 protocol SDP headers are not studied

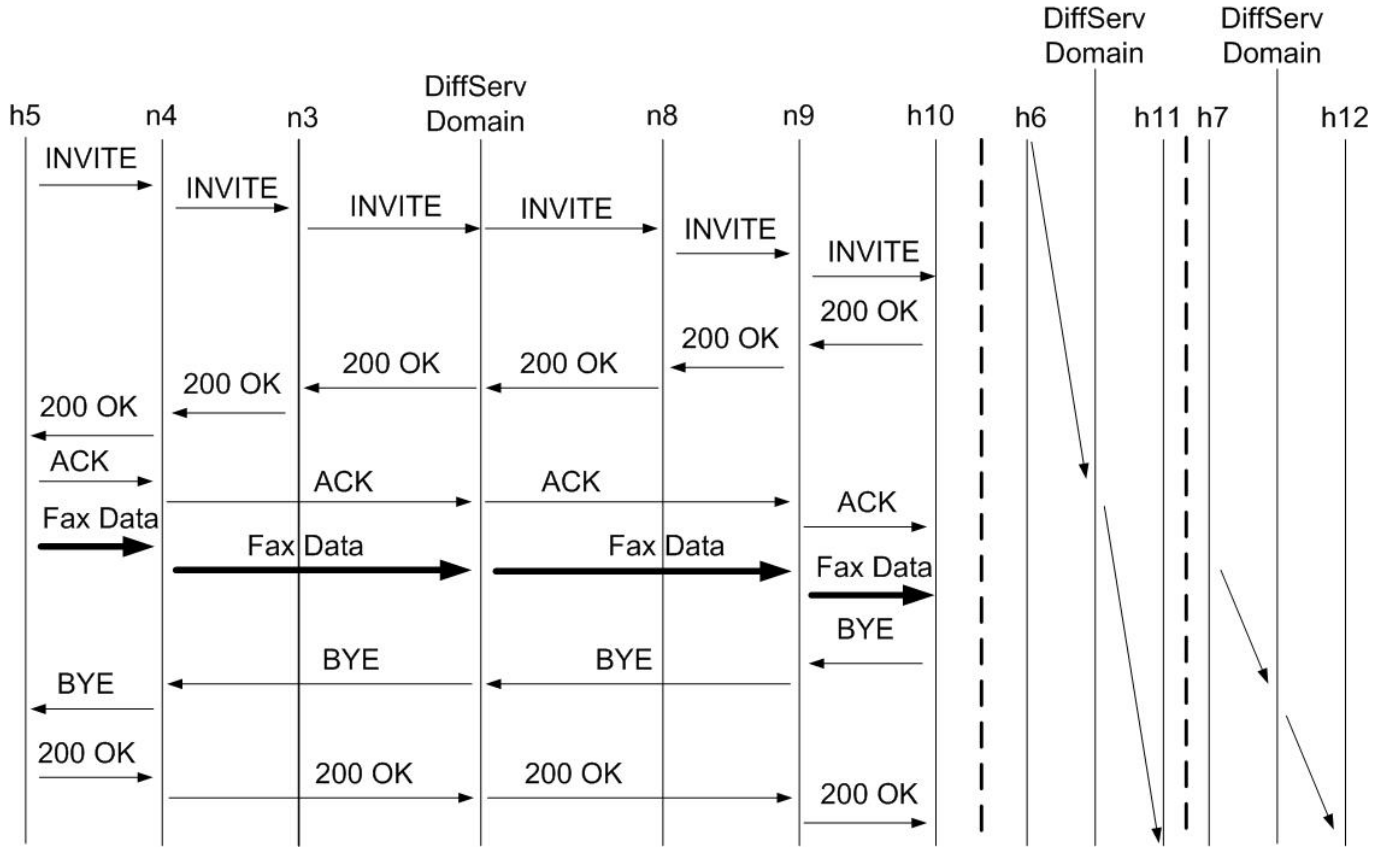
Simulation Scenario



Simulation Scenario Details

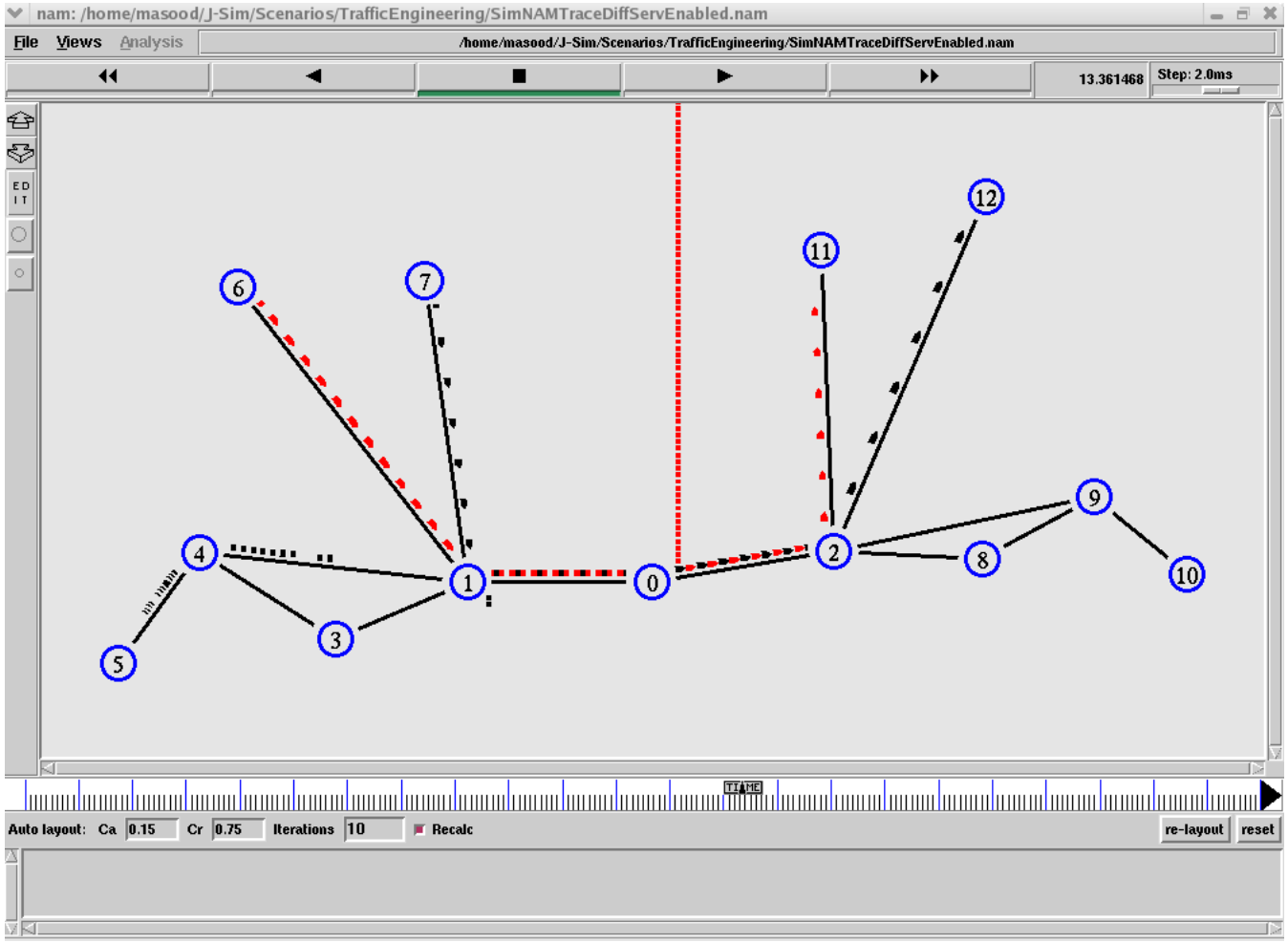
- UDP transport for SIP signaling, TCP for fax packets transfer
- Two constant-bit-rate (CBR) background traffic sources/sinks: h6-h11 and h7-h12;
  the rate of h6 is twice that of h7
- There is a bottleneck in the core router n0
- Tagged traffic classes:
  - h5-h10 (User agents) as “EF”
  - h6-h11 (First background traffic) as “BE”
  - h7-h12 (Second background traffic) as “AF”

The Simulated SIP Call Flow



Utilization of SIP contact header for rerouting signaling away from proxy servers and hence reducing the load on them

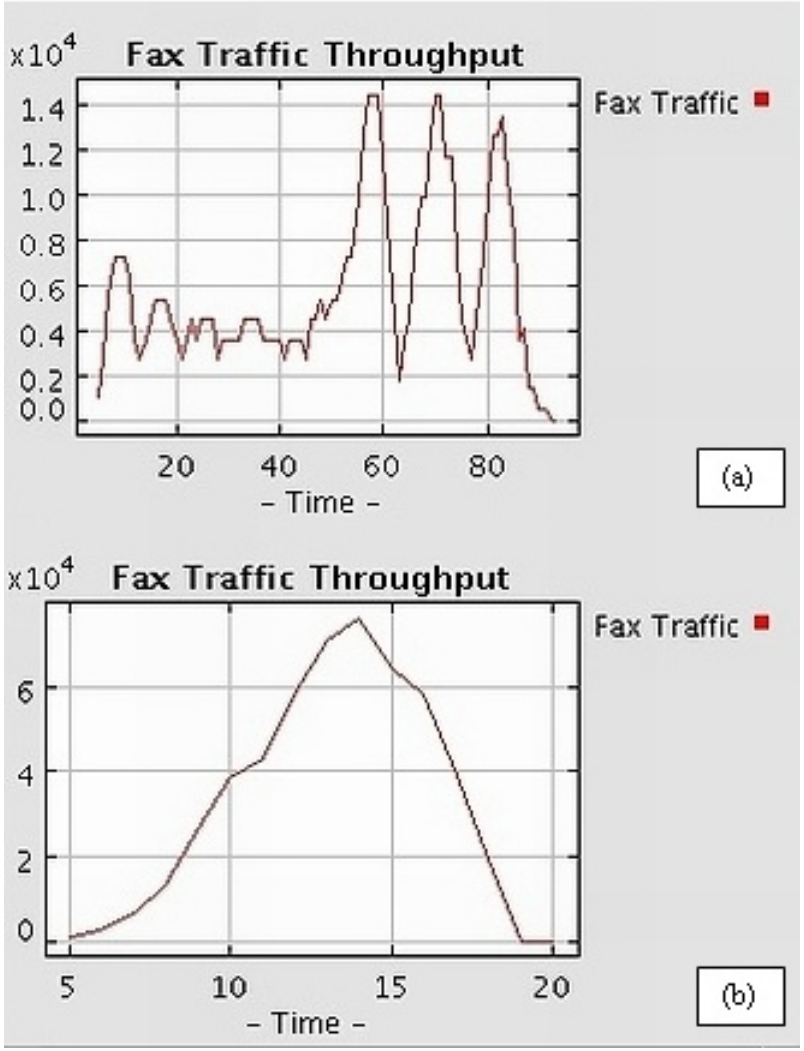
Packets Traces Analyzed With Network Animator



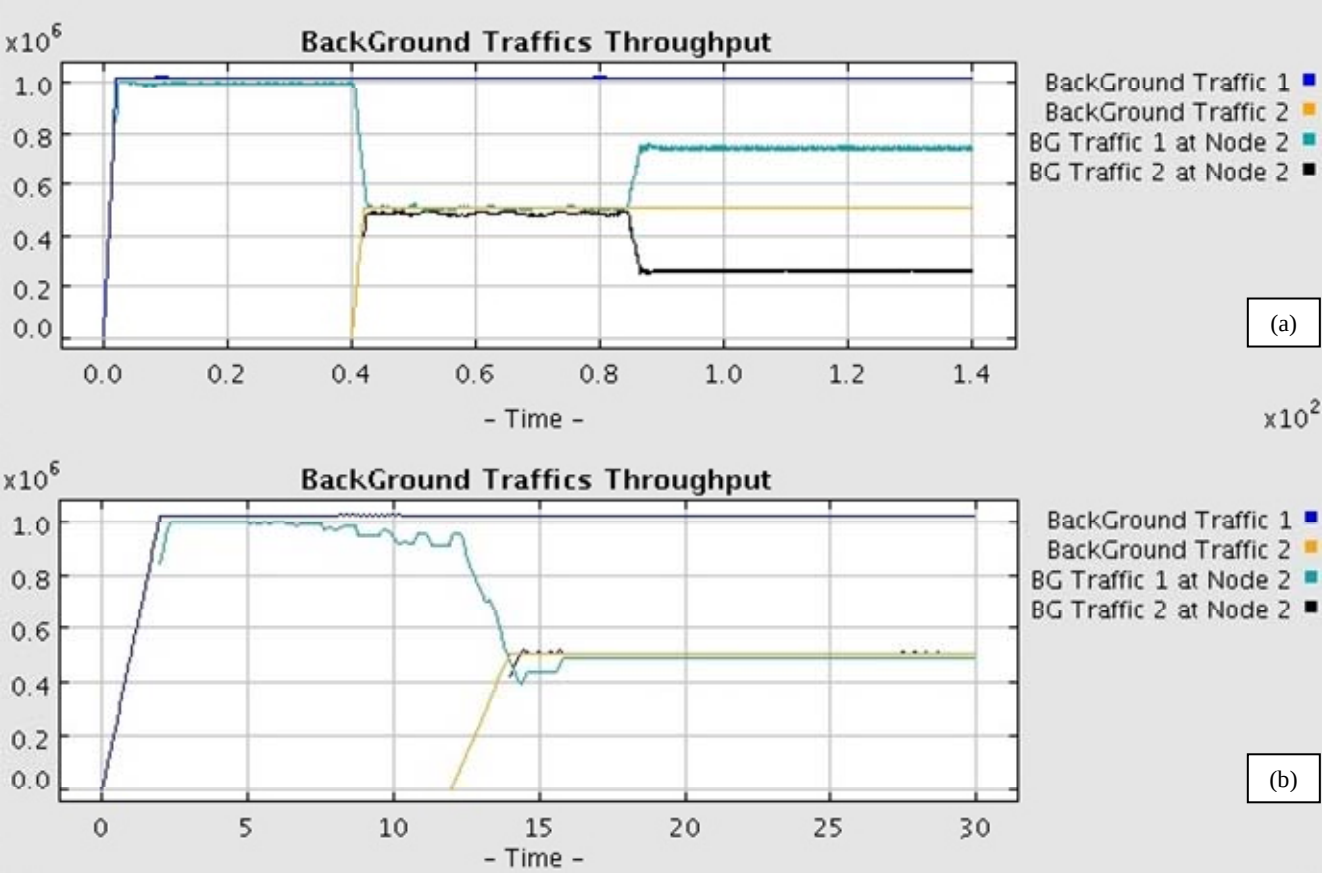
Fax Traffic Throughput

(a) Best Effort

(b) DiffServ

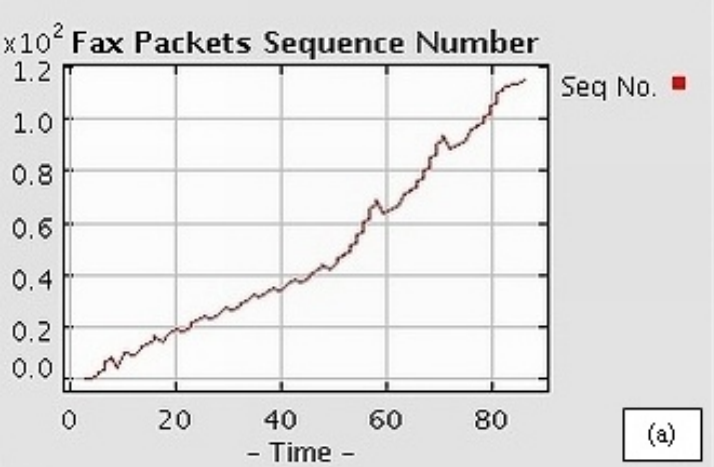


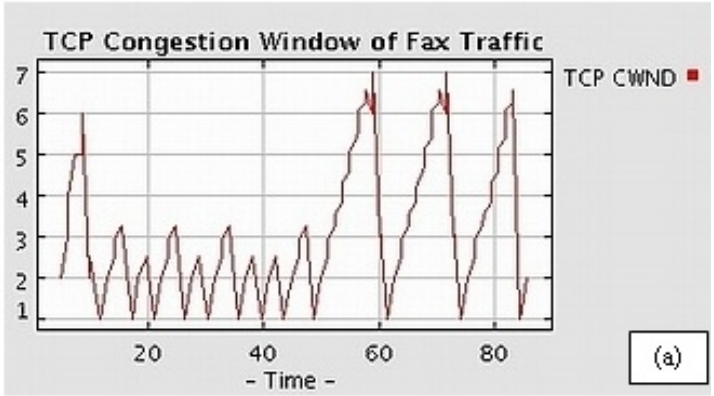
Background Traffics Throughput

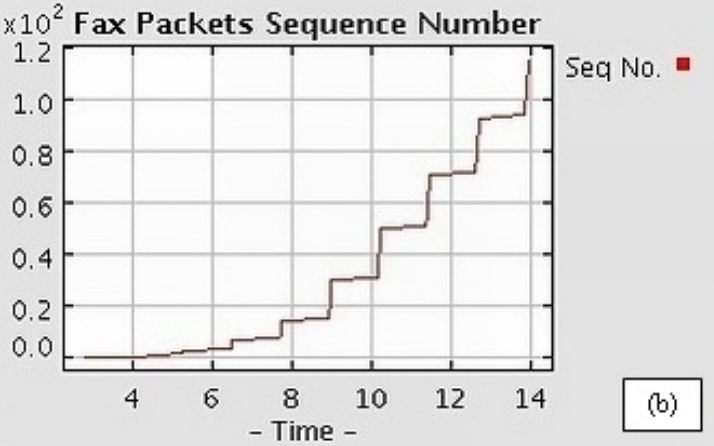


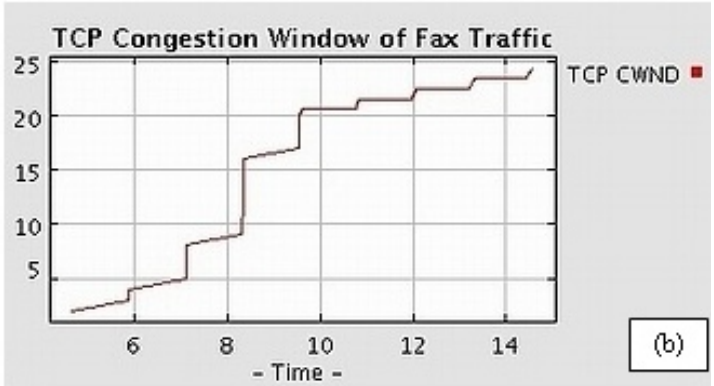
(a) Best Effort, (b) DiffServ

Fax Packets Sequence Numbers & TCP Congestion Window of Fax Traffic









(a) Best Effort, (b) DiffServ

Concluding Remarks

- Adoption of best current practices for real-time fax transmission in IP networks
- Utilization of SIP contact header for reducing the load on proxy servers
- Successful deployment of DiffServ QoS architecture for providing QoS for real-time FoIP as indicated by important monitored traffic parameters
- The emerging QoS architectures will provide even more promising results!

Q&A

END