Kajian Quality Of Service Next Generation Network

Latar Belakang NGN

- Konsep Next Generation Network (NGN) dibangun untuk merealisasikan perkembangan industri telekomunikasi masa depan yang bercirikan konvergensi dan optimasi jaringan, serta berkembangnya jenis digital trafik (layanan multimedia service).
- Konsep NGN juga ditujukan untuk melengkapi teknologi layanan berbasis paket IP sekarang ini (QoS dan sekuriti)

Definisi NGN

Definisi NGN **menurut rekomendasi ITU Y.2001:**

“Next Generation Network (NGN) adalah jaringan berbasis paket yang mampu menyediakan berbagai layanan telekomunikasi, dapat mengintegrasikan teknologi broadband dan narrowband, menyediakan QoS (Quality of Service), memiliki layer aplikasi yang independent terhadap layer transport, memungkinkan akses tanpa batas ke berbagai penyedia layanan dan mendukung mobilitas untuk menyediakan layanan di mana saja dan kapan saja bagi pengguna”

Definisi Menurut **Ilmu Komputer.com:**

“Next Generation Network (NGN) adalah jaringan yang dirancang untuk memenuhi kebutuhan infrastruktur infokom abad ke 21 yang tidak lagi diharapkan bersifat TDM, melainkan sudah dalam bentuk paket-paket yang efisien, namun dengan QoS terjaga”

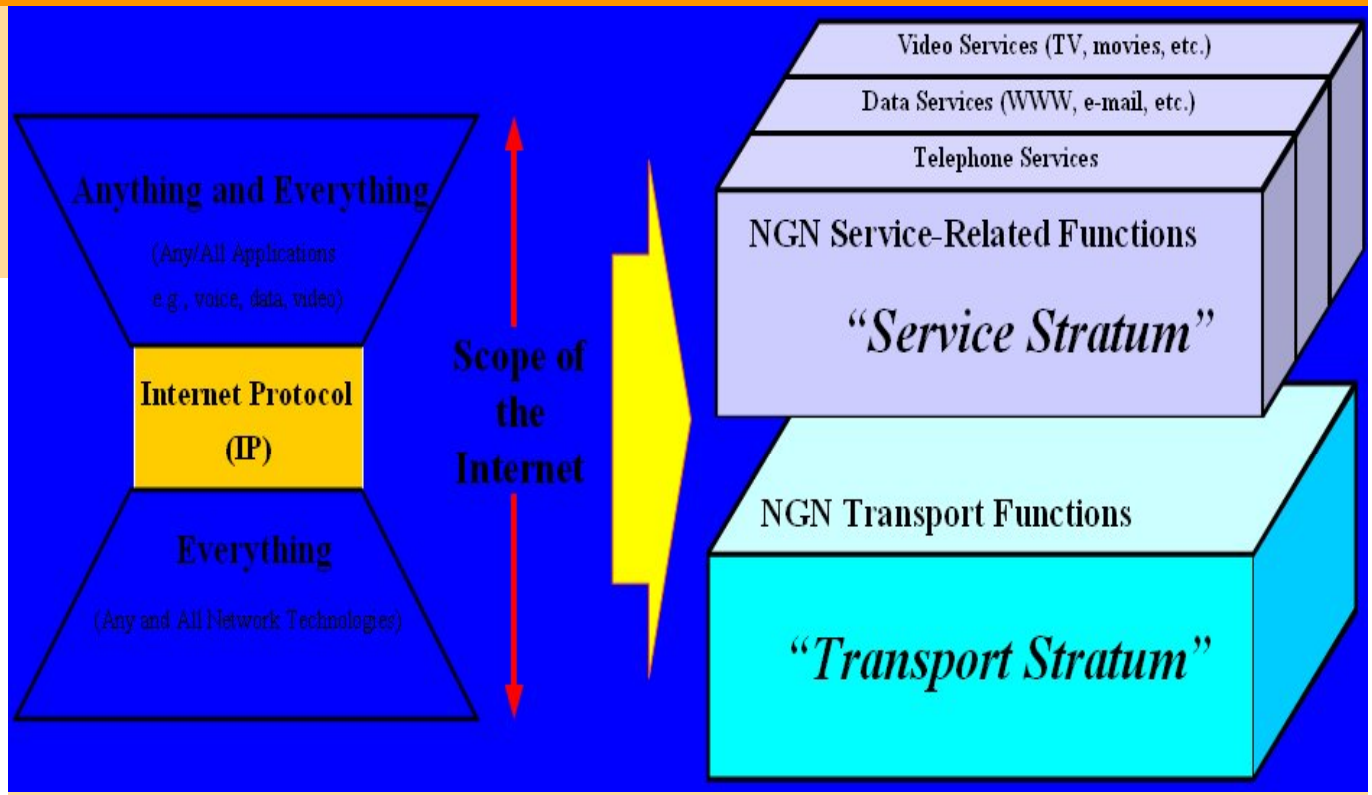
Definisi NGN

Dari definisi di atas dapat disimpulkan 4 hal fundamental mengenai NGN :

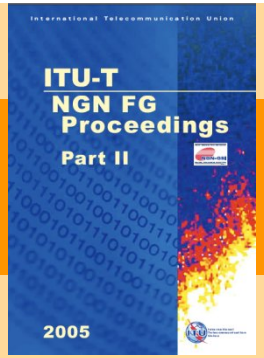
- Packet based
- Multimedia-Multiservice/Multi networks
- Fungsi service dan transport yang independen
- **QoS**

Definisi NGN

Layer 7	
Layer 6	Service stratum
Layer 5	
Layer 4	
Layer 3	
Layer 2	Transport stratum
Layer 1	
OSI BRM's view	**NGN strata's view**



Definisi QoS NGN, referensi



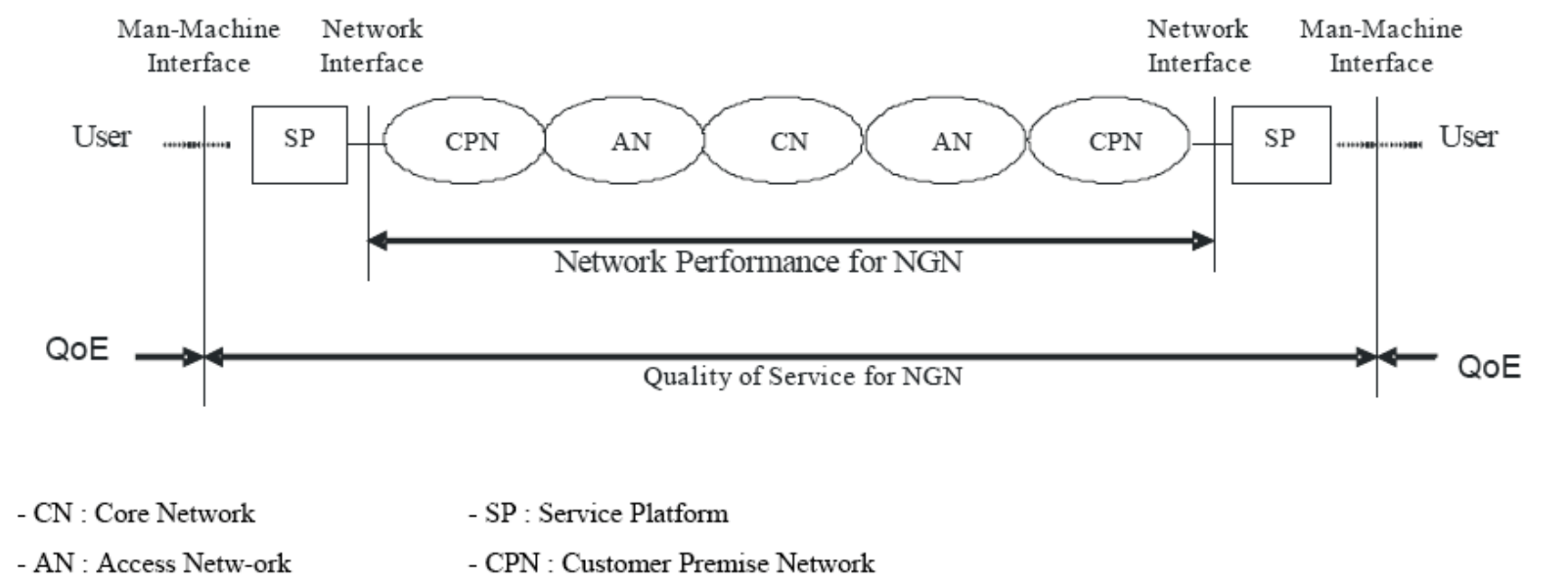
- Definisi QoS Menurut rekomendasi ITU-T E.800

" Kumpulan dampak performansi layanan yang mana menentukan tingkat kepuasan pengguna layanan"

- Daftar referensi rekomendasi ITU-T yang berhubungan dengan QoS NGN (*menurut buku ITU-T NGN FG Proceedings part II)* :

– Rec. E.800 Terms and definitions related to quality of service and network performance including dependability
– Rec. G.1000 Communications quality of service: A framework and definitions
– Rec. G.1010 End-user multimedia QoS categories
– Rec. I.350 General aspects of quality of service and network performance in digital networks, including ISDNs
– Rec. I.356 B-ISDN ATM layer cell transfer performance
– Rec. X.800 Security Architecture for Open Systems Interconnection for CCITT applications
– Rec. X.805 Security Architecture for systems providing end-to-end communications
– Rec.Y.1540 Internet protocol data communication service - IP packet transfer and availability performance parameters
– Rec.Y.1541 Network performance objectives for IP-based services
– Rec. Y.1560 Parameters for TCP connection performance in the presence of middleboxes
– Rec. Y.1561 Performance and Availability Parameters for MPLS Networks
– Rec. Y.2011 General principles and general reference model for NGNs

End-End QoS NGN



Observasi End-End QoS :

1.Aplikasi Layer,

- Untuk servis yang ditawarkan harus ada syarat yang diperlukan (Bandwidth, delay, packet loss, dll)
- Aplikasi berkomunikasi ke jaringan core dan akses untuk memastikan syarat QoS tersebut

2.Transport Layer,

- Access Network, Core Network (biasanya dengan MPLS)

End-End QoS NGN

- Berdasarkan rekomendasi ITU Y.2011, servis NGN harus mensupport koneksi user-user, maka dari itu kajian End-End QoS sebaiknya dikelompokan berdasarkan aplikasi (Application QoS Classes)
- Selain *Application QoS Classes* dikenal ada *Network QoS Classes* (pengkategorian QoS berdasar jaringan dan teknologi spesifik <IP-**REC Y.1541**,ATM-**REC I.1536**>)
- NGN mensuport jaringan dengan tipe yang berbeda (non-homogenous network).Akan timbul masalah ketika mengkategorikan QoS berdasarkan jaringannya (Network QoS Classes) karena sulit melakukan mapping class QoS yang berbeda jaringan ketika 2 jaringan yang berbeda itu interkoneksi.

Application QoS classes	Network QoS classes
Service acceptability	Network capability
Network technology independent	Network technology dependent
NGN service stratum	NGN transport stratum
Requested/selected by user: the end-to-end service	Supported by service/network provider: the end-to-end network
User-required performance	Network-supporting performance

Y.1541-Network QoS Classes Based On IP Performance

Network Performance Parameter	Nature of Network Performance Objective	Class 0	Class 1	Class 2	Class 3	Class 4	Class 5
IPTD (ip packet transfer delay)	Upper bound on the mean IPTD	100 ms	400 ms	100 ms	400 ms	1 s	U
IPDV (IP packet delay variation)	Upper bound on the $1-10^{-3}$ quantile of IPTD minus the minimum IPTD	50 ms	50 ms	U	U	U	U
IPLR (Ip packet loss ratio)	Upper bound on the packet loss probability	$1*10^{-3}$	$1*10^{-3}$	$1*10^{-3}$	$1*10^{-3}$	$1*10^{-3}$	U
IPER (IP packet error ratio)	Upper bound	$1*10^{-4}$					U

Application QoS Classes

1.Berdasarkan ekspektasi end user pada kelemahan sistem dan tidak bergantung kepada jenis teknologi dan jaringan yang ada. tetapi klasifikasinya sebaiknya mudah diaplikasikan ke kelas QoS jaringan yang ada untuk implementasi dan operasi.

2.Memberikan indikasi batas atas dan bawah yang dapat diterima oleh user.

3.Menunjukan parameter performansi (delay,delay variation, loss, dll) dan secara objektif dapat dikelompok-kelompokan dengan tepat.

G.1010-End User Multimedia Categories

Medium	Application	Degree of symmetry	Typical data rates	Key performance parameters and target values			
				One-way delay	**Delay variation**	**Information loss (Note 2)**	**Other**
Audio	Conversational voice	Two-way	4-64 kbit/s	<150 ms preferred (Note 1) <400 ms limit (Note 1)	< 1 ms	< 3% packet loss ratio (PLR)	
Audio	Voice messaging	Primarily one-way	4-32 kbit/s	< 1 s for playback < 2 s for record	< 1 ms	< 3% PLR	
Audio	High quality streaming audio	Primarily one-way	16-128 kbit/s (Note 3)	< 10 s	<< 1 ms	< 1% PLR	
Video	Videophone	Two-way	16-384 kbit/s	< 150 ms preferred (Note 4) <400 ms limit		< 1% PLR	Lip-synch: < 80 ms
Video	One-way	One-way	16-384 kbit/s	< 10 s		< 1% PLR	

NOTE 1 – Assumes adequate echo control.

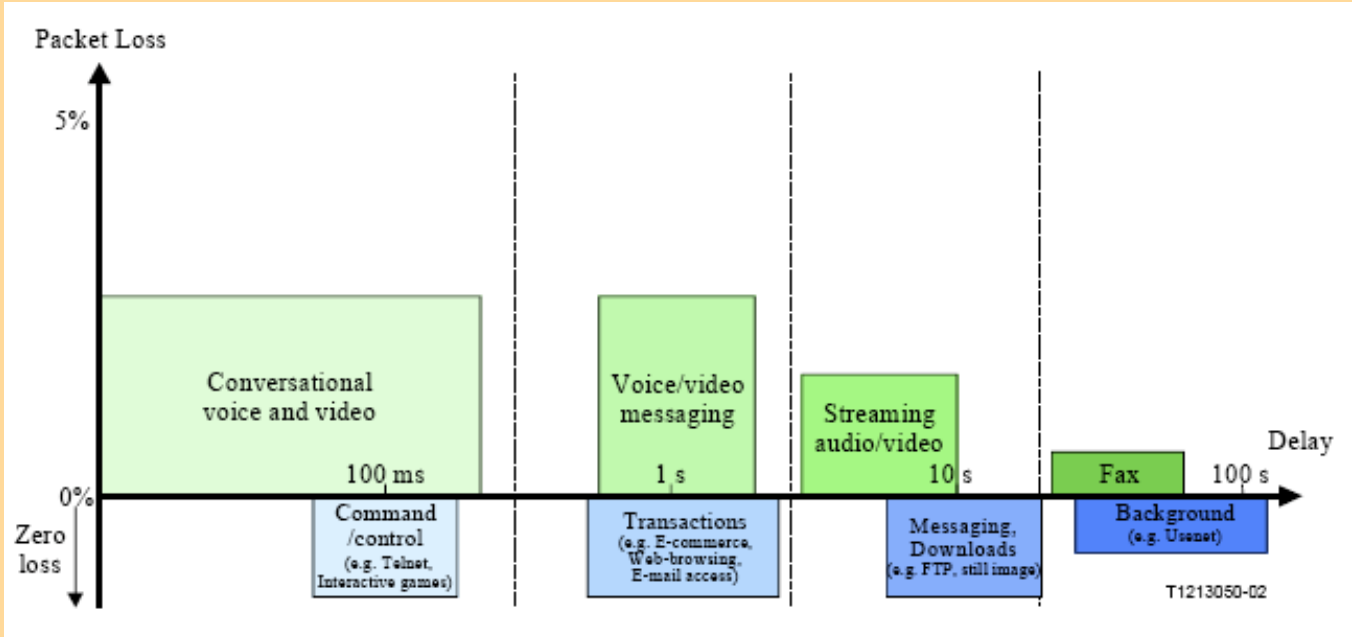
NOTE 2 – Exact values depend on specific codec, but assumes use of a packet loss concealment algorithm to minimise effect of packet loss.

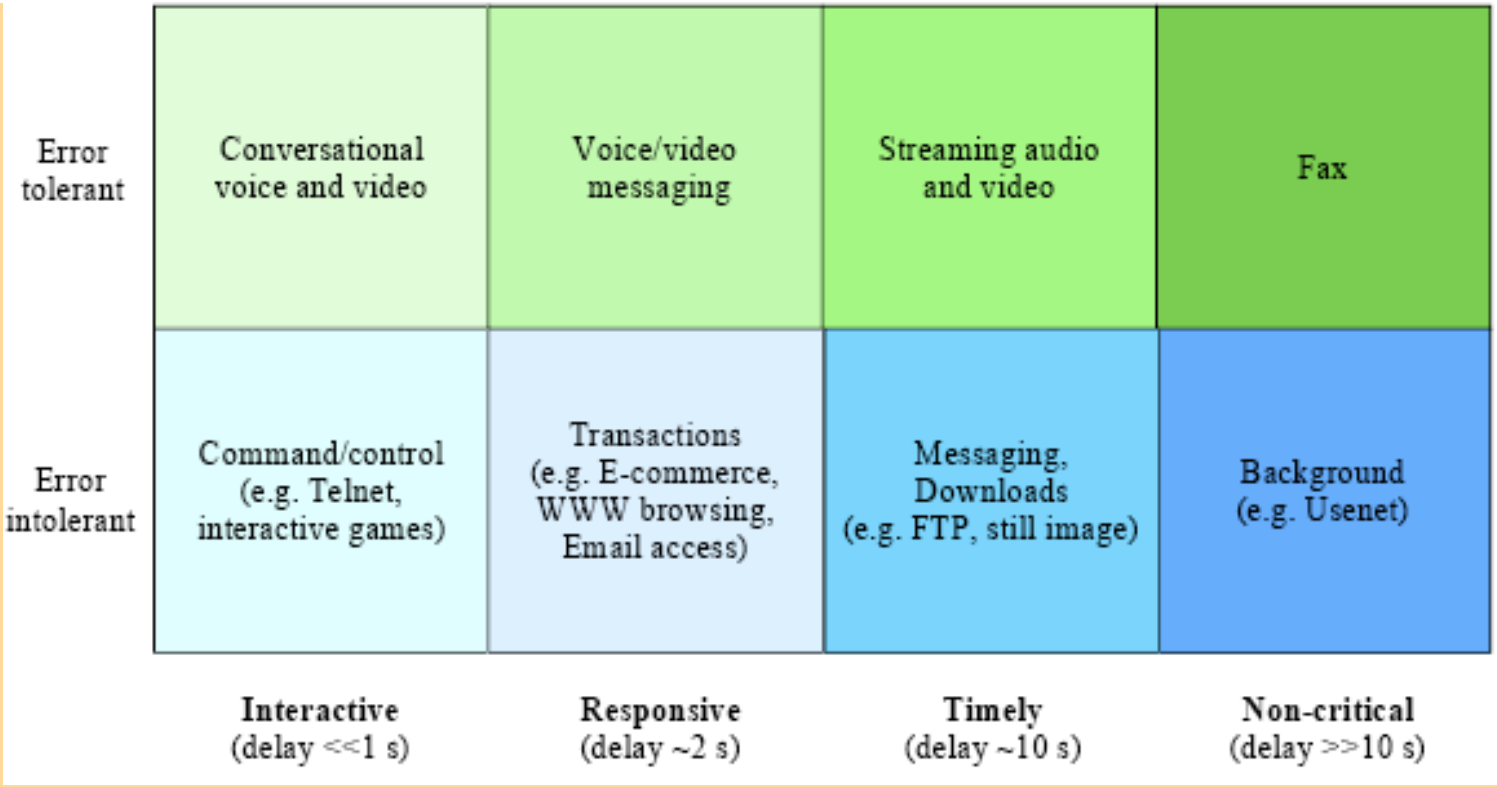
NOTE 3 – Quality is very dependent on codec type and bit-rate.

NOTE 4 – These values are to be considered as long-term target values which may not be met by current technology.

G.1010-End User Multimedia Categories

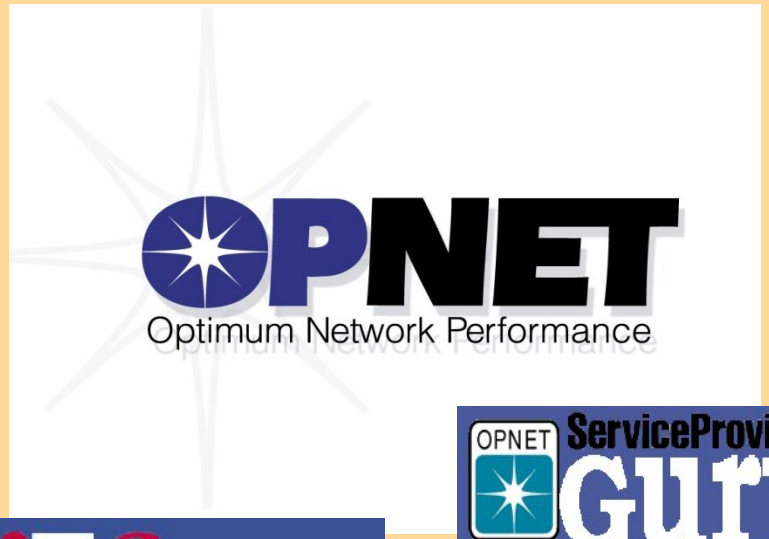
Medium	Application	Degree of symmetry	Typical amount of data	Key performance parameters and target values		
				One-way delay (Note)	Delay variation	Information loss
Data	Web-browsing – HTML	Primarily one-way	~10 KB	Preferred < 2 s /page Acceptable < 4 s /page	N.A.	Zero
Data	Bulk data transfer/retrieval	Primarily one-way	10 KB-10 MB	Preferred < 15 s Acceptable < 60 s	N.A.	Zero
Data	Transaction services – high priority e.g. e-commerce, ATM	Two-way	< 10 KB	Preferred < 2 s Acceptable < 4 s	N.A.	Zero
Data	Command/control	Two-way	~ 1 KB	< 250 ms	N.A.	Zero
Data	Still image	One-way	< 100 KB	Preferred < 15 s Acceptable < 60 s	N.A.	Zero
Data	Interactive games	Two-way	< 1 KB	< 200 ms	N.A.	Zero
Data	Telnet	Two-way (asymmetric)	< 1 KB	< 200 ms	N.A.	Zero
Data	E-mail (server access)	Primarily one-way	< 10 KB	Preferred < 2 s Acceptable < 4 s	N.A.	Zero
Data	E-mail (server to server transfer)	Primarily one-way	< 10 KB	Can be several minutes	N.A.	Zero
Data	Fax ("real-time")	Primarily one-way	~ 10 KB	< 30 s/page	N.A.	$<10^{-6}$ BER
Data	Fax (store & forward)	Primarily one-way	~ 10 KB	Can be several minutes	N.A.	$<10^{-6}$ BER
Data	Low priority transactions	Primarily one-way	< 10 KB	< 30 s	N.A.	Zero
Data	Usenet	Primarily one-way	Can be 1 MB or more	Can be several minutes	N.A.	Zero


Packet Loss
5%
0%
Zero loss
Conversational voice and video
Voice/video messaging
Streaming audio/video
Fax
Delay
100 ms
1 s
10 s
100 s
Command /control
(e.g. Telnet, Interactive games)
Transactions
(e.g. E-commerce, Web-browsing, E-mail access)
Messaging, Downloads
(e.g. FTP, still image)
Background
(e.g. Usenet)
T1213050-02


Error tolerant
Error intolerant
Conversational voice and video
Voice/video messaging
Streaming audio and video
Fax
Command/control (e.g. Telnet, interactive games)
Transactions (e.g. E-commerce, WWW browsing, Email access)
Messaging, Downloads (e.g. FTP, still image)
Background (e.g. Usenet)
Interactive (delay <<1 s)
Responsive (delay ~2 s)
Timely (delay ~10 s)
Non-critical (delay >>10 s)

QoS Simulation Tools

- Kajian ini akan dibantu dengan software **OPNET IT Guru Version** (http://www.opnet.com), yang memiliki beberapa kegunaan antara lain :
  - Troubleshooting
    - Network configuration error
    - Permasalahan performansi
  - Operational validation
    - Perubahan konfigurasi
    - Protokol tuning
    - Pre-provisioning
  - Automated Design
    - Topology
    - Dimensioning
    - Traffic engineering
  - Planning
    - Kapasitas
    - Evaluasi teknologi
    - Pemenuhan SLA (Service Level Agreement)



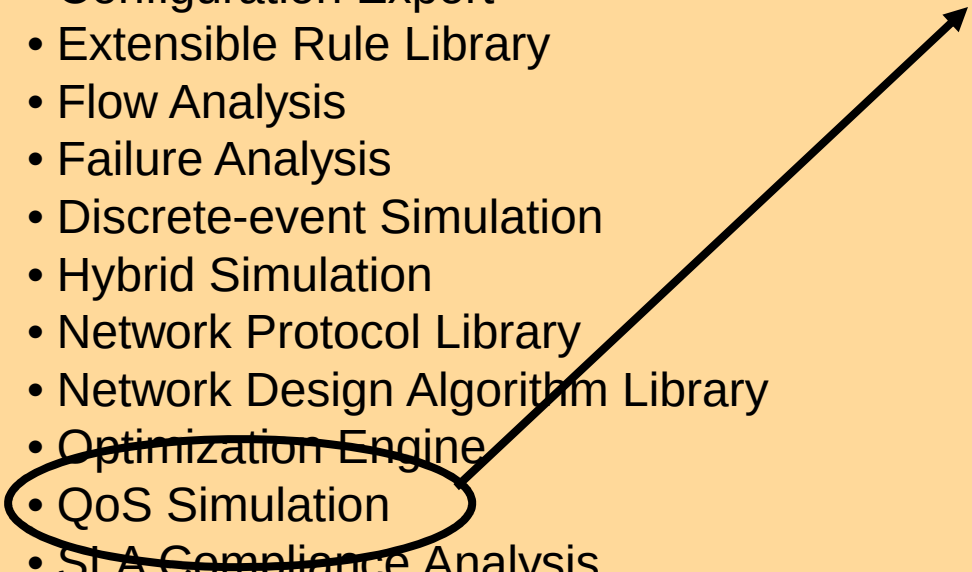




OPNET IT Guru

Berikut ini aplikasi teknologi yang dapat dilakukan dengan OPNET :

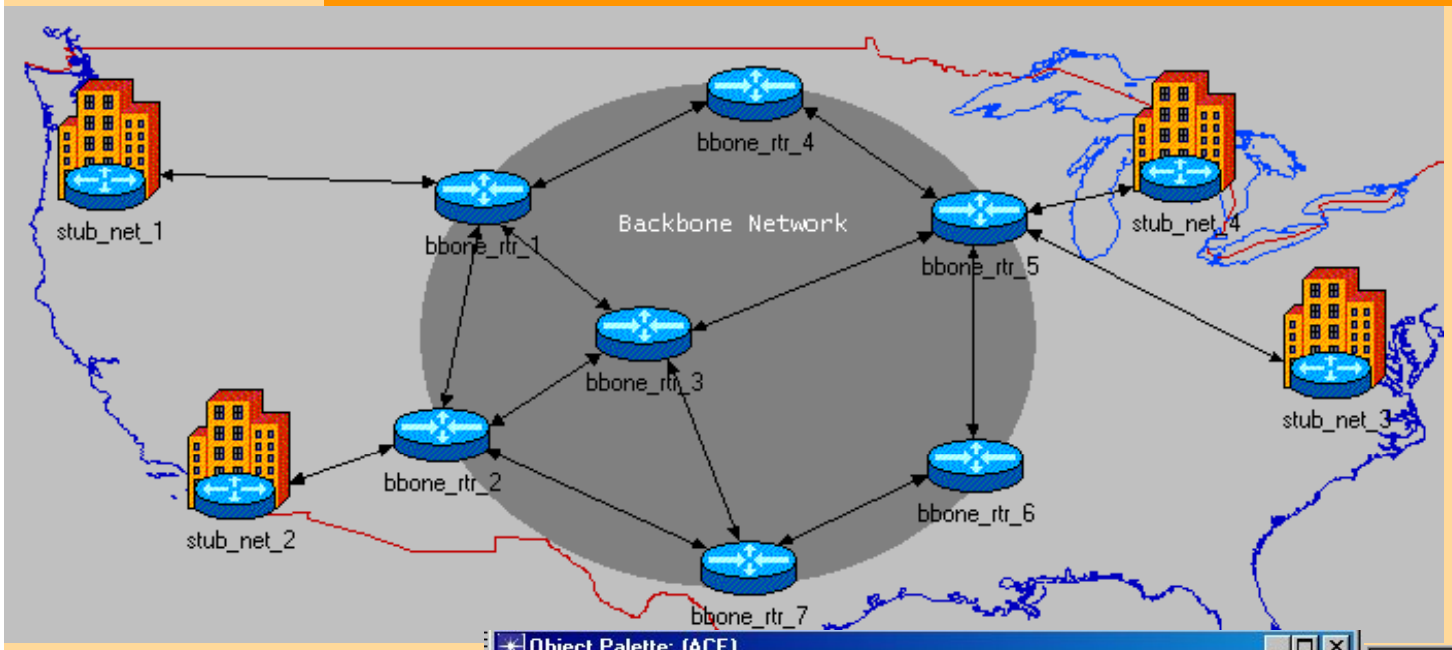
- Automated Import / Model Generation
- Configuration Validation
- Configuration Export
- Extensible Rule Library
- Flow Analysis
- Failure Analysis
- Discrete-event Simulation
- Hybrid Simulation
- Network Protocol Library
- Network Design Algorithm Library
- Optimization Engine
- QoS Simulation
- SLA Compliance Analysis
- Packet Capture Agents
- Application Performance Analysis and Troubleshooting
- Open API
- XML Interfaces

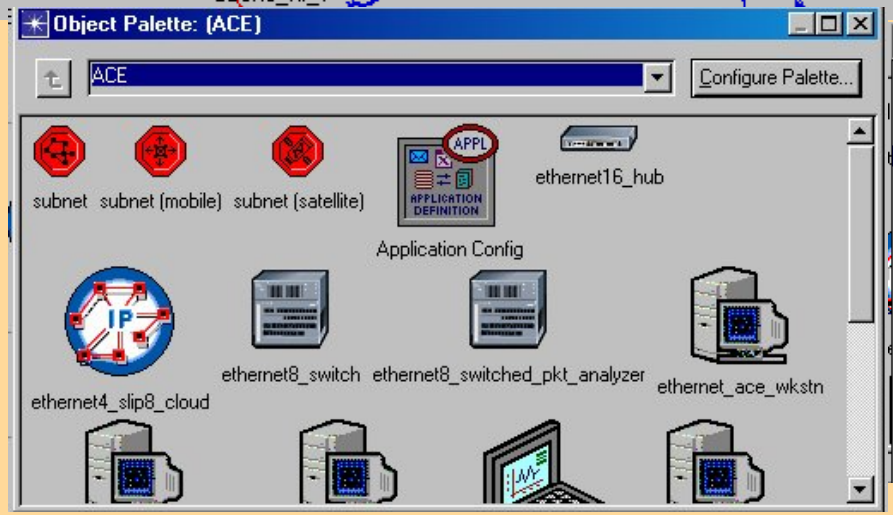


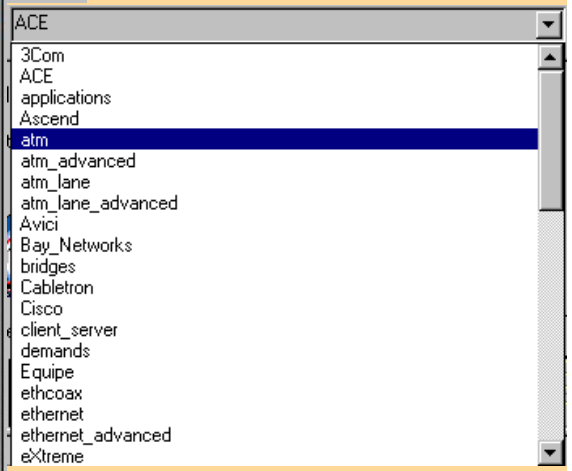
Hal ini yang memungkinkan OPNET dapat digunakan sebagai tools untuk mengkaji QoS NGN

Sumber : OPNET-BPPT

OPNET IT Guru







Sumber : OPNET-BPPT

OPNET Model Library

Application Layer Models
- Custom Application
- Database
- E-mail
- HTTP
- Print → **Rekomendasi G.1010**
- Voice
- Video

Transport Protocols
- TCP
- NCP
- UDP

Routing Protocols
- OSPF
- BGP
- IGP
- RIP
- EIGP

Network Layer Protocols
- IP
- IPX
- RSVP

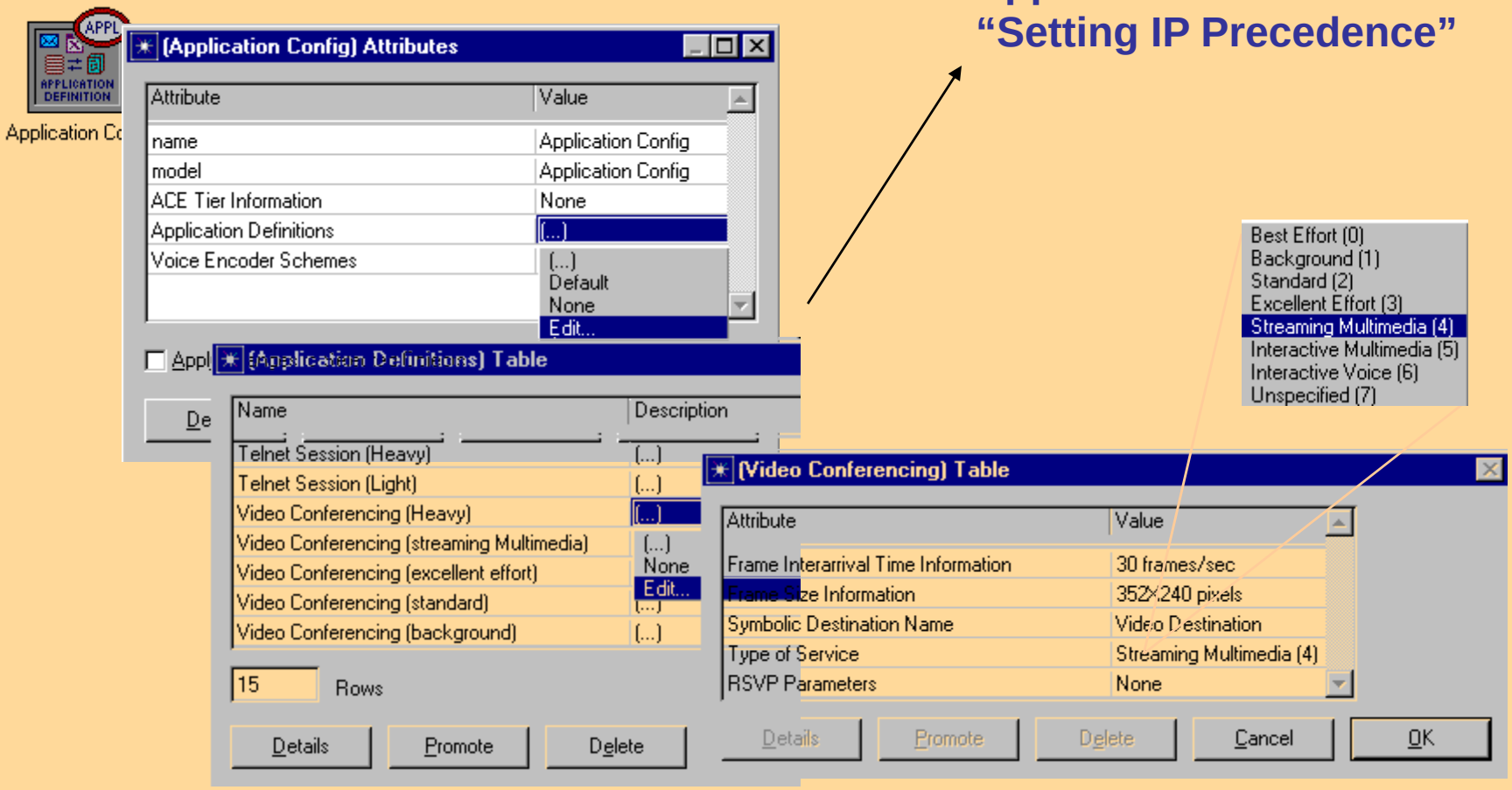
Data Link Layer Technologies
- ATM
- Ethernet (10/100/1000)
- Ether Channel
- FDDI
- Frame Relay
- LAN Emulation
- Link Access Procedure - Balanced
- Spanning Tree Bridge
- Spatial Reuse Protocol
- System Network Architecture
- Token Ring
- VLAN
- X.25

Physical Layer Technologies
- SONET
- xDSL
- ISDN

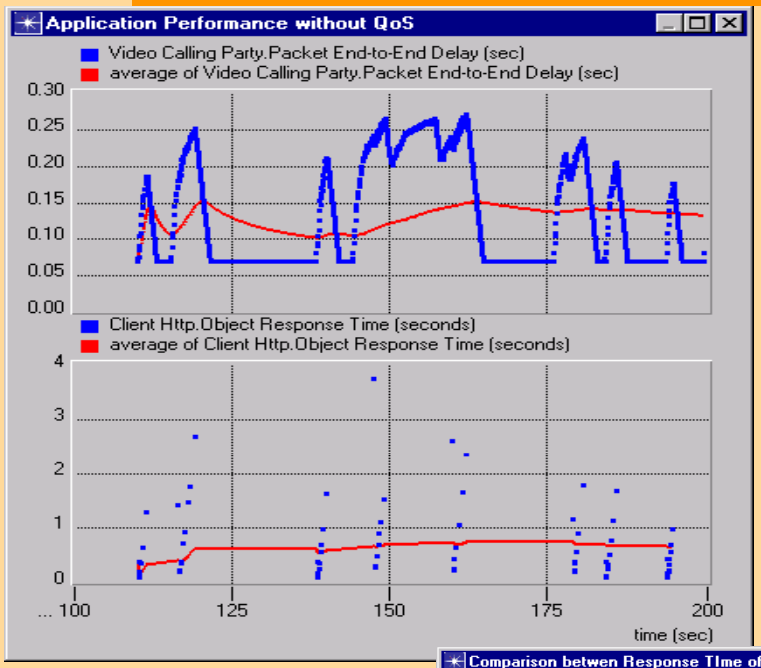
Vendor Device Models
- 3Com
- Avici Systems
- Cableltron
- Cisco
- Extreme Networks
- Foundry Networks
- Hewlett-Packard
- Juniper
- Lucent & Ascend
- Marconi Systems (Fore Systems)
- Newbridge
- Nortel & Bay Networks

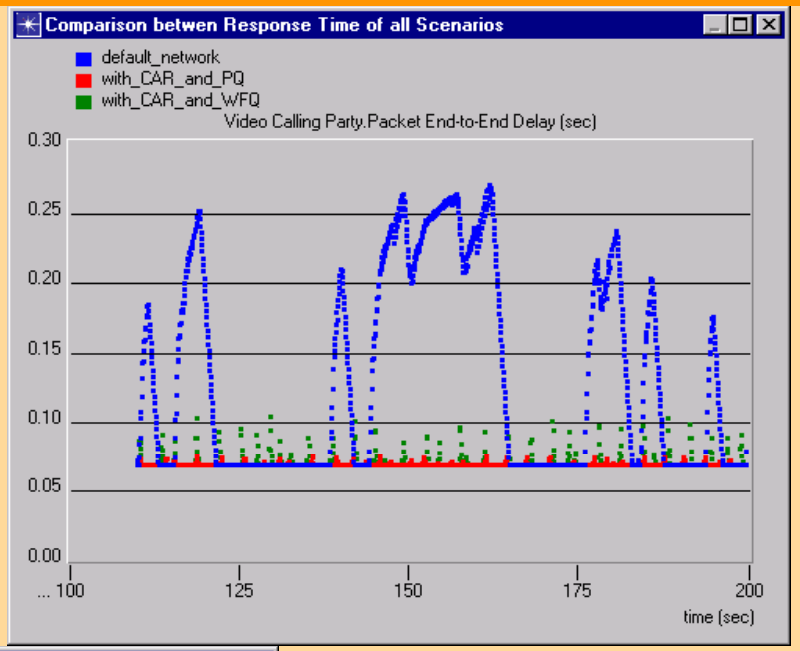
Example (1)

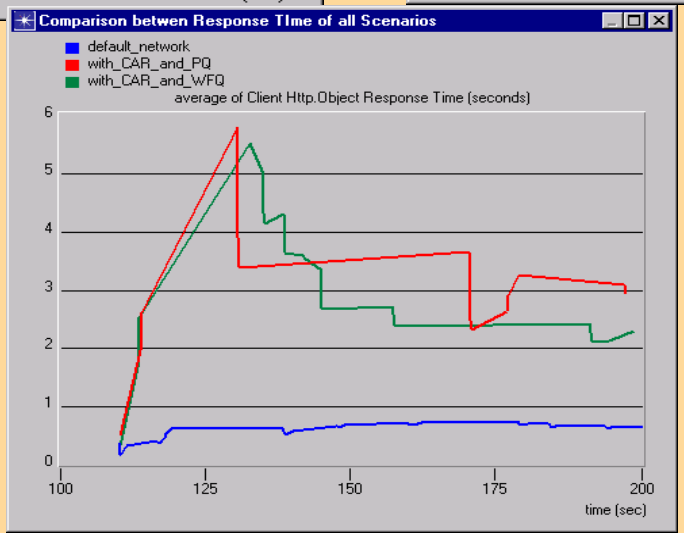
Application traffic :
“Setting IP Precedence”



Example (2)


Application Performance without QoS
Video Calling Party.Packet End-to-End Delay (sec)
average of Video Calling Party.Packet End-to-End Delay (sec)
0.30
0.25
0.20
0.15
0.10
0.05
0.00
Client Http.Object Response Time (seconds)
average of Client Http.Object Response Time (seconds)
4
3
2
1
0
... 100
125
150
175
200
time (sec)


Comparison betwen Response Time of all Scenarios
default_network
with_CAR_and_PQ
with_CAR_and_WFQ
Video Calling Party.Packet End-to-End Delay (sec)
0.30
0.25
0.20
0.15
0.10
0.05
0.00
... 100
125
150
175
200
time (sec)


Comparison betwen Response TIme of all Scenarios
default_network
with_CAR_and_PQ
with_CAR_and_WFQ
average of Client Http.Object Response Time (seconds)
6
5
4
3
2
1
0
100
125
150
175
200
time (sec)