ITU Cross Regional Seminar on Broadband Access (Fixed, Wireless including Mobile) for CIS, ASP and EUR Regions

Traffic Demand Trends and Modeling for Broadband

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Agenda

- Services traffic trends on Broadband
- Traffic demand activities and processes
- Traffic modeling for BB services

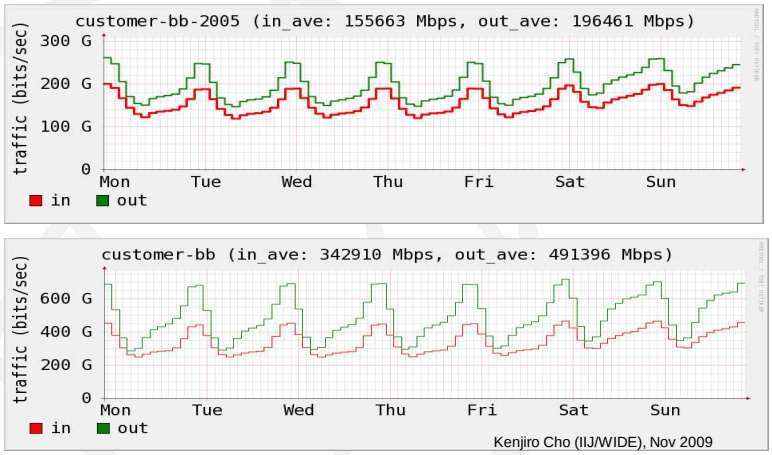
Traffic related questions

- Is traffic important in NGN and IP flows?
- What units to consider for dimensioning, charging and engineering?
- Which traffic activities are needed in operation?
- Which units to consider for interconnection and SLA?
- How to ensure a balanced dimensioning for BW hungry applications?
- Others……?

Broadband Service traffic demand: Recent trends

- Major increase of data traffic both in fixed and mobile networks (mainly video, browsing and social networks)
- More heterogeneous behavior (up to 20:1 in volume and 10:1 in signaling for new terminals) and in session composition due to the multiplicity of terminals and applications
- Different proportion of busy hour traffic to the overall daily traffic as compared with traditional (> 25%)
- Several Origin/Destination patterns/matrix and flow modeling mainly in mobile
- Need for a continuous process in traffic measurement, projection and dimensioning

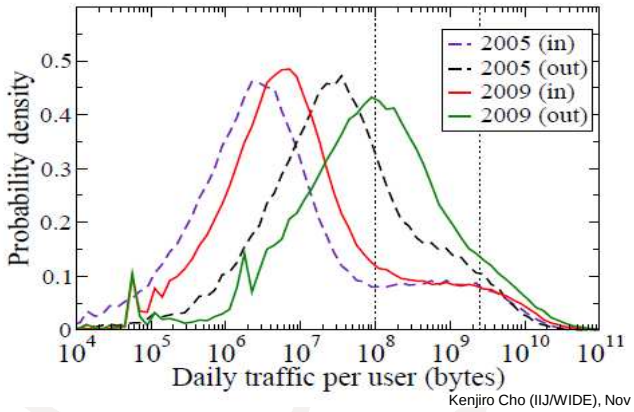
Broadband Service traffic demand: Recent trends



Kenjiro Cho (IIJ/WIDE), Nov 2009

• Evolution of traffic daily profile in Japan 2005-2009: (daily periodicity maintained, increase of peakdness for busy period and asymmetry D/U)

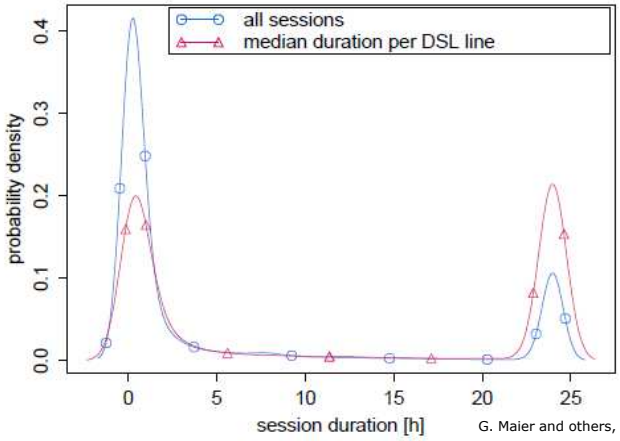
Broadband Service traffic demand: Recent trends



Kenjiro Cho (IIJ/WIDE), Nov 2009

• Evolution of traffic volume distribution per day in Japan: (mode multiplied by ~ 50 in 4 years)

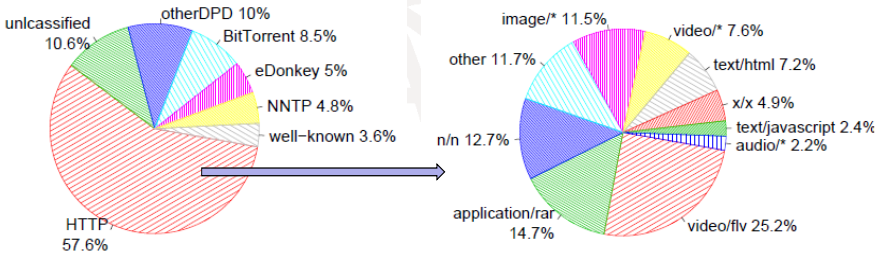
Broadband Service traffic demand: Recent trends



G. Maier and others, T-Lab, Nov 2009

• Diversity of customers behaviour with peaks at short and long durations

Broadband Service traffic demand: Recent trends



G. Maier and others, T-Lab, Nov 2009

• Mix of applications with HTTP dominant overall and high increase of video

• Need to careful follow-up to avoid the “bandwidth crunch”

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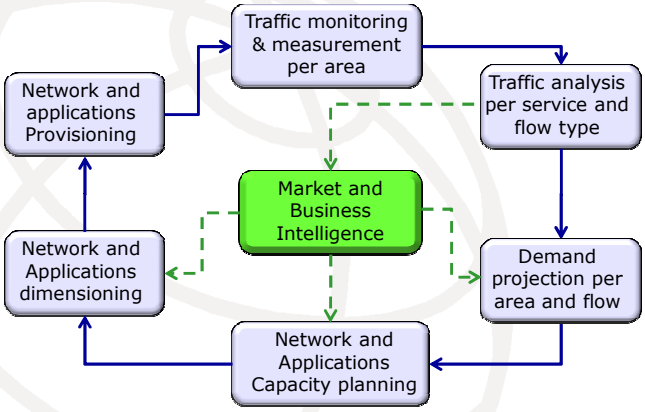
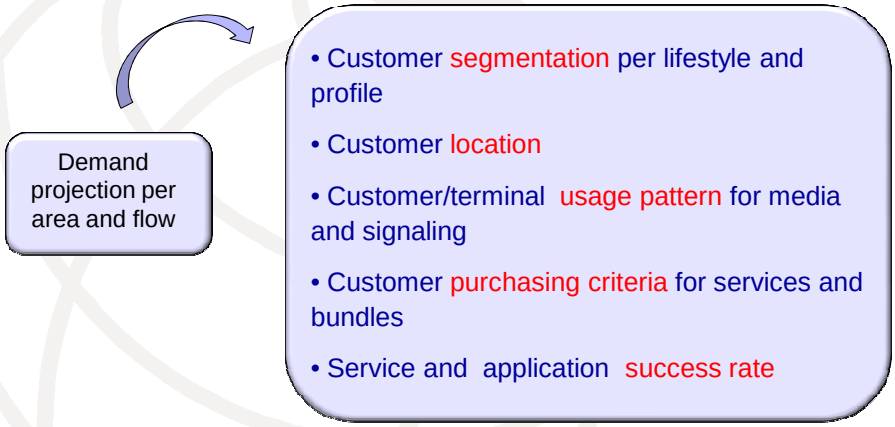
Broadband Service traffic demand: Required Traffic Activities for NGN



Traffic/Planning activities and continuous cycle to engineer network according to the very dynamic evolution of applications (specially on mobile)

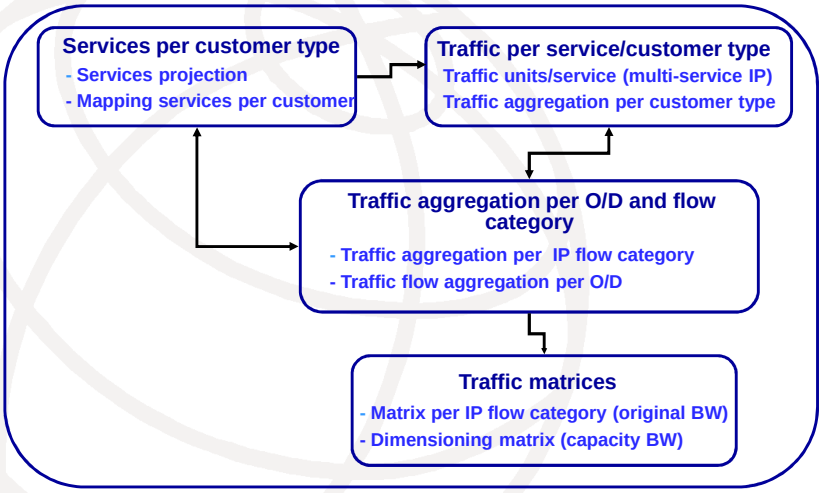
Broadband Service traffic demand: Traffic activities for NGN



Broadband Service traffic demand: Traffic matrix characterization criteria

- Per O/D network points (end to end user, user to service providers location and multiple to multiple O/D)
- Per dimensioning criteria (constant, guaranteed streaming, best effort)
- Per application type (Video, Web, Bulk, P2P, Social networking, Gaming, etc.)
- Per customer category (Wholesale, LAN, business, residential)

Broadband Service demand evaluation process



Reference points for inter-domain performance measurement by ITU

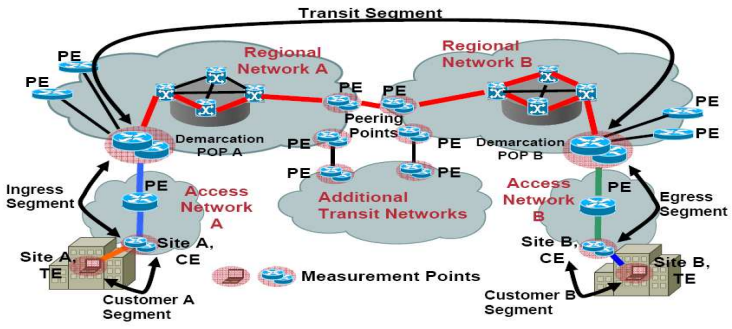


Figure 5/Y.1543 - TE-TE Model

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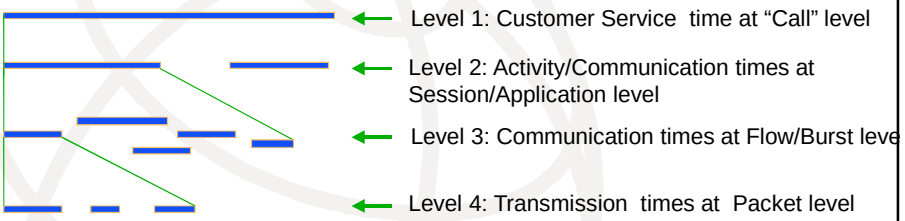
Traffic Characterization

- Hierarchical modelling for call driven communications generating traffic flows in NGN



- Aggregated average traffic per level as a weighted average of the services categories (i) and customer classes (j) at that level.

Traffic Characterization for NGN

- **Which** units used to predict traffic demand ?

Traditional

- Customers for given project (operator, country, region, worldwide)
- Ports associated to customers per class
- Calls generated at user interface
- Erlangs originated/terminated at user interface

New

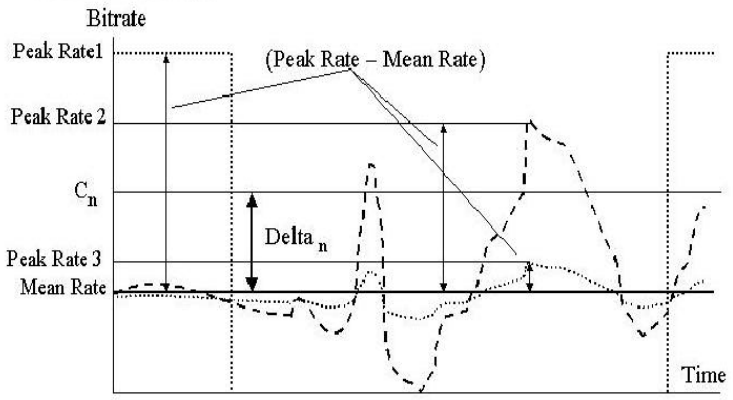
- Sessions/Information/requests generated at user interface
- Packets handled at a given resource through the network
- Mbits transported through a given network link/path

Traffic flow types for Quality of Service based dimensioning

- **constant stream**: bandwidth transmission at a constant speed with a specified delivery and jitter (ie: video distribution)
- **variable stream** : bandwidth transmission at a variable speed derived from a user information and coding algorithm which requires guaranteed quality and specified jitter (ie: VoIP, Video streaming, audio streaming, etc.)
- **elastic:** bandwidth transmission at a variable speed without jitter restrictions and asynchronous delivery (ie: browsing, file transfer, mail, UMS, etc.)

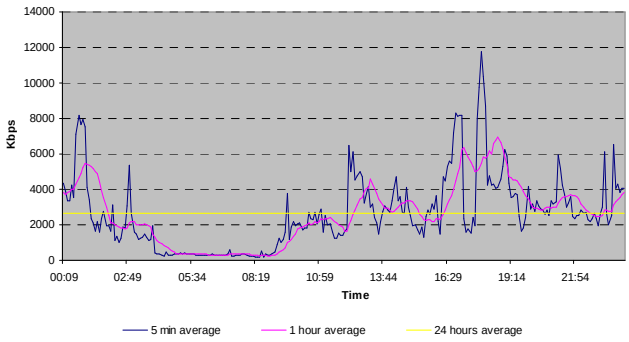
Traffic Characterization for NGN

• Different relation between peak traffic and average traffic per service classes: CBR (1), VBR(2), VBR(3)



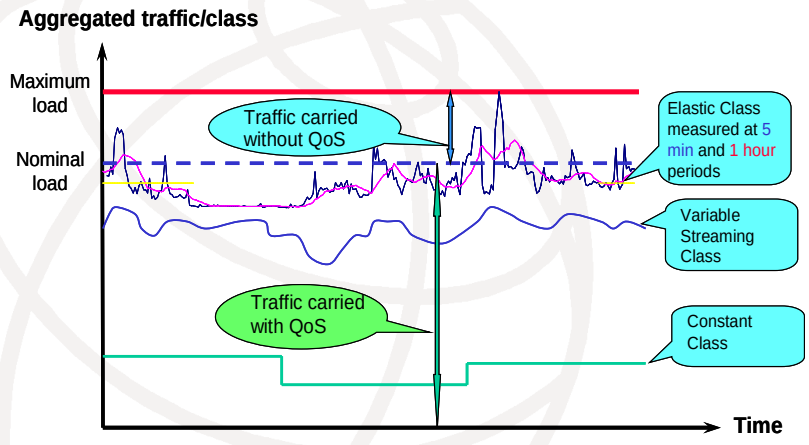
Example of time-scale influence on measurements

Variation per measurement averaging period at ENST campus measurements in 2001 for advanced internet applications



- Impact of averaging period
  - 1,8:1 ratio between "5 min" and "1 hour"
  - 2,3:1 ratio between "1 hour" and "24 hours"

Example of aggregated flows per category



Traffic units for aggregated flows

- Traffic Units definition for network dimensioning
  - Equivalent Sustained Bit Rate (ESBR) or aggregated equivalent rates for same QoS category flows in a common reference busy period (ie. 5 minutes)
  - Computed as weighted average of the services at QoS category (i) and customer classes (j) at each network element: $\Sigma_i \Sigma_j ESBR_{ij}$

Dimensioning Criteria

- **Stream traffics** need reserve capacity procedures like MPLS and Call Acceptance Control (CAC) in the access and may be modeled with equivalent bandwidth methods.
  - ⇒ Available "multi-rate formulas" with different peakdness factors for a given quality.
- **Elastic traffics** may be modeled with resource shared models.
  - ⇒ Available "processor-sharing" models that provide a minimum capacity and a delivery speed as a function of simultaneous users
- **Constant rate** traffics need to be aggregated and reserved on top of the others with a given protection factor
- Overall dimensioning will be a combination of the previous procedures with different degrees of detail as a function of the model granularity

Traffic/pricing management for better services monetization

- Measure traffic bandwidth and signaling evolutions for new applications and smart terminals
- Consider busy periods specific for mobile services and geographical areas
- Introduce intelligent traffic management to handle flows according to services priorities
- Manage service pricing to transfer traffic from peak periods to valleys
- Introduce dynamic pricing per application according to traffic and quality required by smart terminals

Recommendations

- Consider traffic activities as a central role within the operational processes and business management
- Perform network measurements, dimensioning and engineering with the specific IP models for QoS
- Apply intelligent traffic management together with intelligent pricing to avoid the “bandwidth crunch” and optimize benefits