Overflow in VBR

Overflow

Actual traffic > capacity

Short time (a few time slots) ⇒ data delayed

Long time (many time slots) ⇒ buffer overflow ⇒ data lost

Overflow probability

Average traffic rate = M x λ

Average data arriving in time T = M x λ x T

Capacity rate = N x B

Data capacity in time T = N x B x T

Overflow in time T

Actual data arriving in time T > N x B x T

N x B x T + 1 or N x B x T +2 or N x B x T +3 or ...

Independent outcomes

$$P(\text{overflow}) = P(\text{NBT}+1 \; or \; \text{NBT}+2 \; or \; ...) = \sum_{k=\text{NBT}+1}^{\infty} \frac{(\text{M}\lambda\text{T})^k}{k!} e^{-(\text{M}\lambda\text{T})}$$

Overflow Example

Average traffic on network

λ = 10 packets / second per node

M = 10 nodes

Average packets in 0.1 second = M x λ x T

= 10 nodes x (10 packets / second per node) x 0.1 second

= 10 packets

Maximum traffic on network (capacity)

B = 30 packets / second per node

N = 4 nodes

Maximum packets in 0.1 second = N x B x T

= 4 nodes x (30 packets / second per node) x 0.1 second

= 12 packets

Overflow condition for T = 0.1 second

Overflow if actual traffic > N x B x T

$$P(\text{overflow}) = \sum_{k=13}^{\infty} \frac{(10)^k}{k!} e^{-(10)} = 0.21 = 21\%$$