

Migrating from Circuit to Packet Voice - *Ensuring Consistent Voice Quality*

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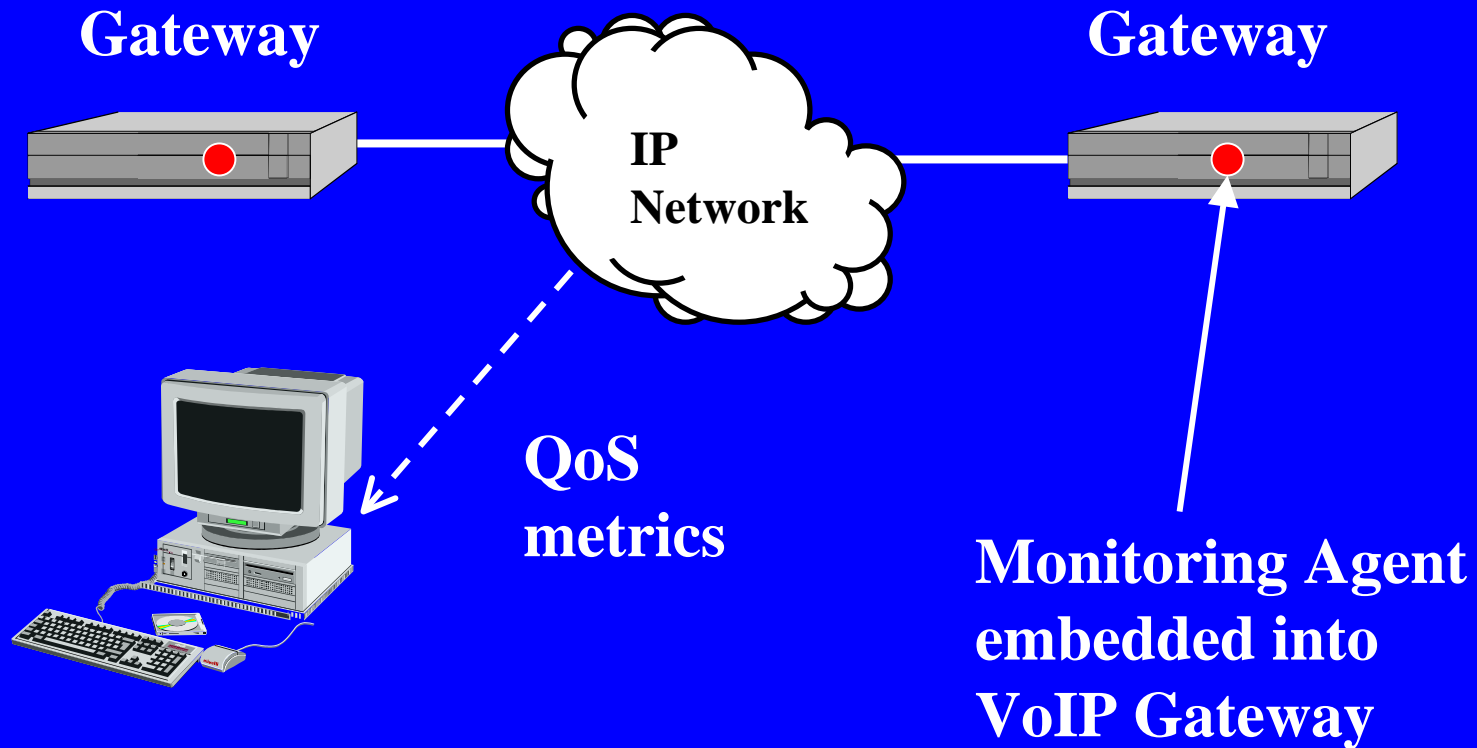
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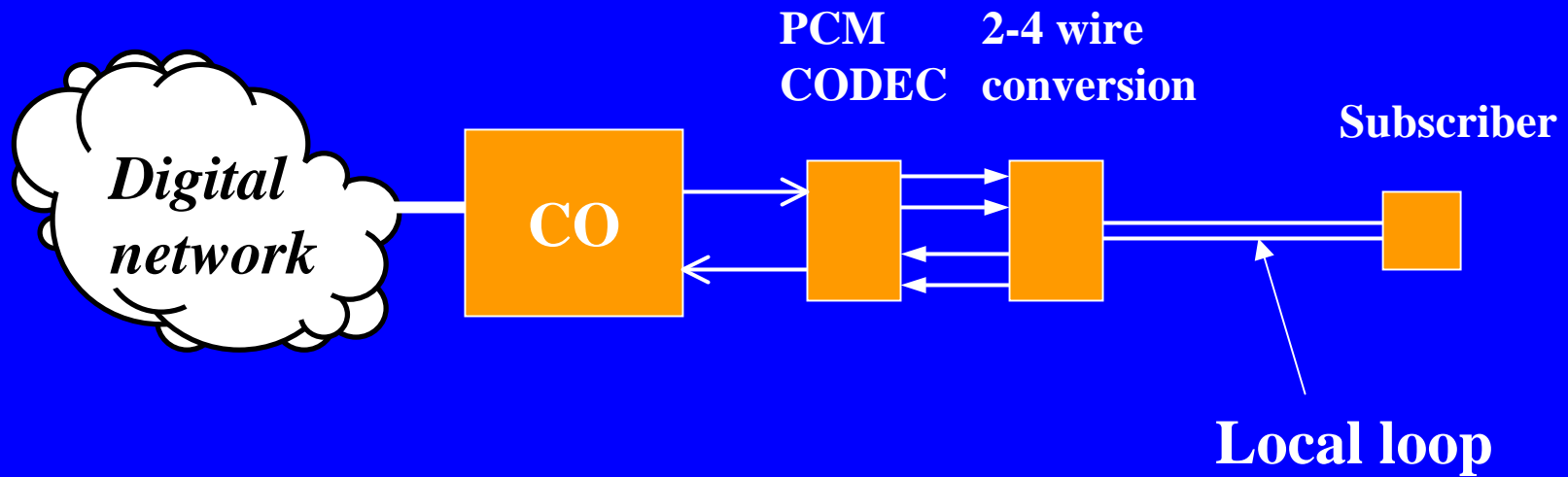
Ensuring Consistent Voice Quality

- Circuit switched voice vs Packet switched voice
- Measuring Voice Quality
- Active Testing
- Embedded Passive Monitoring

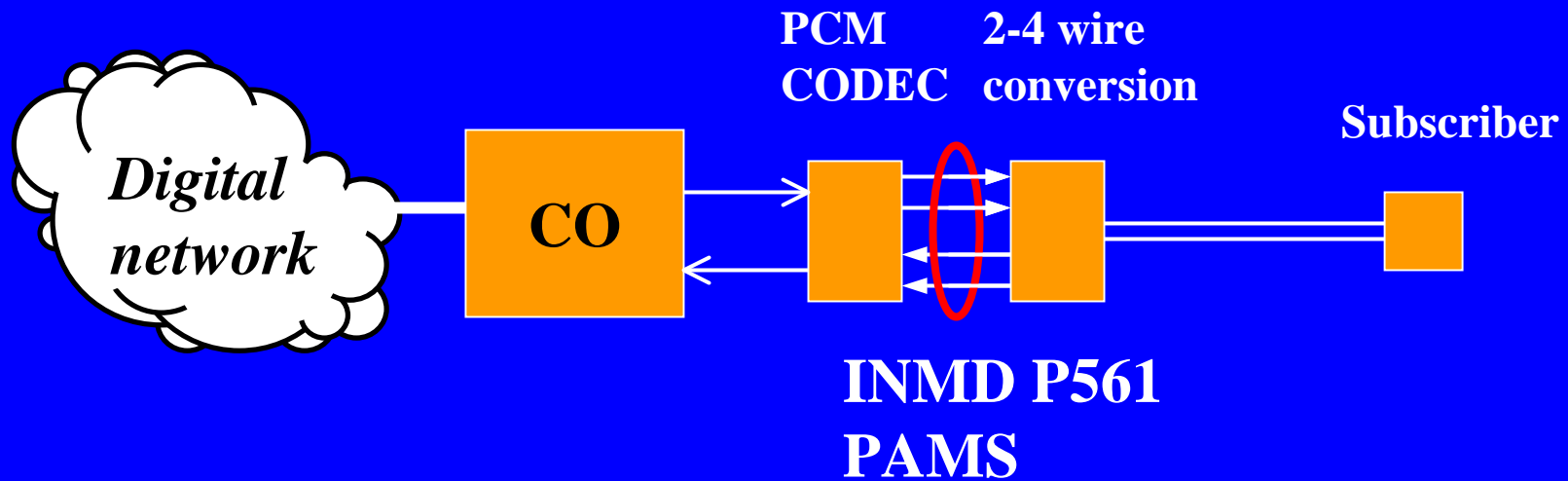
Embedded Passive Monitoring



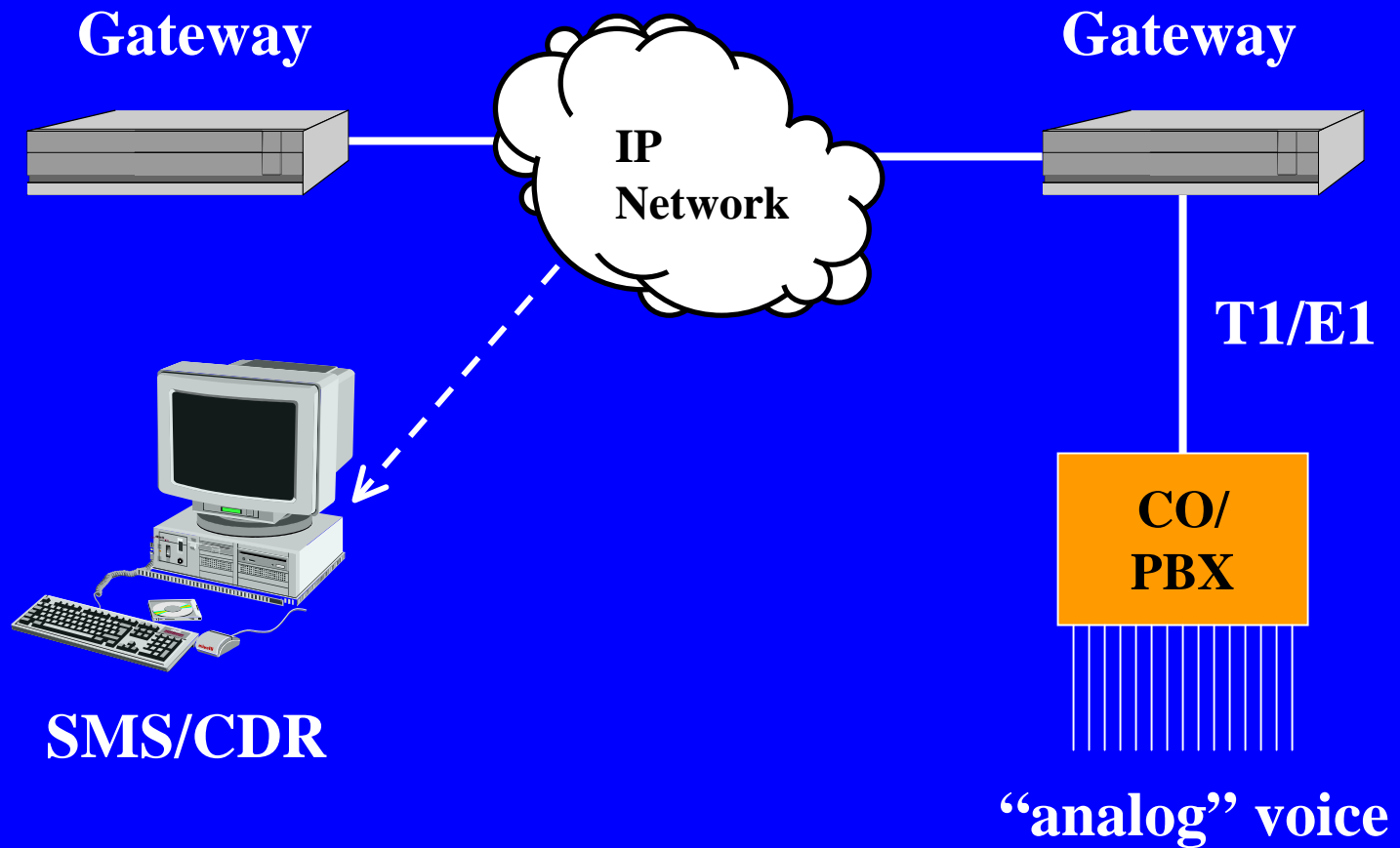
Circuit switched model



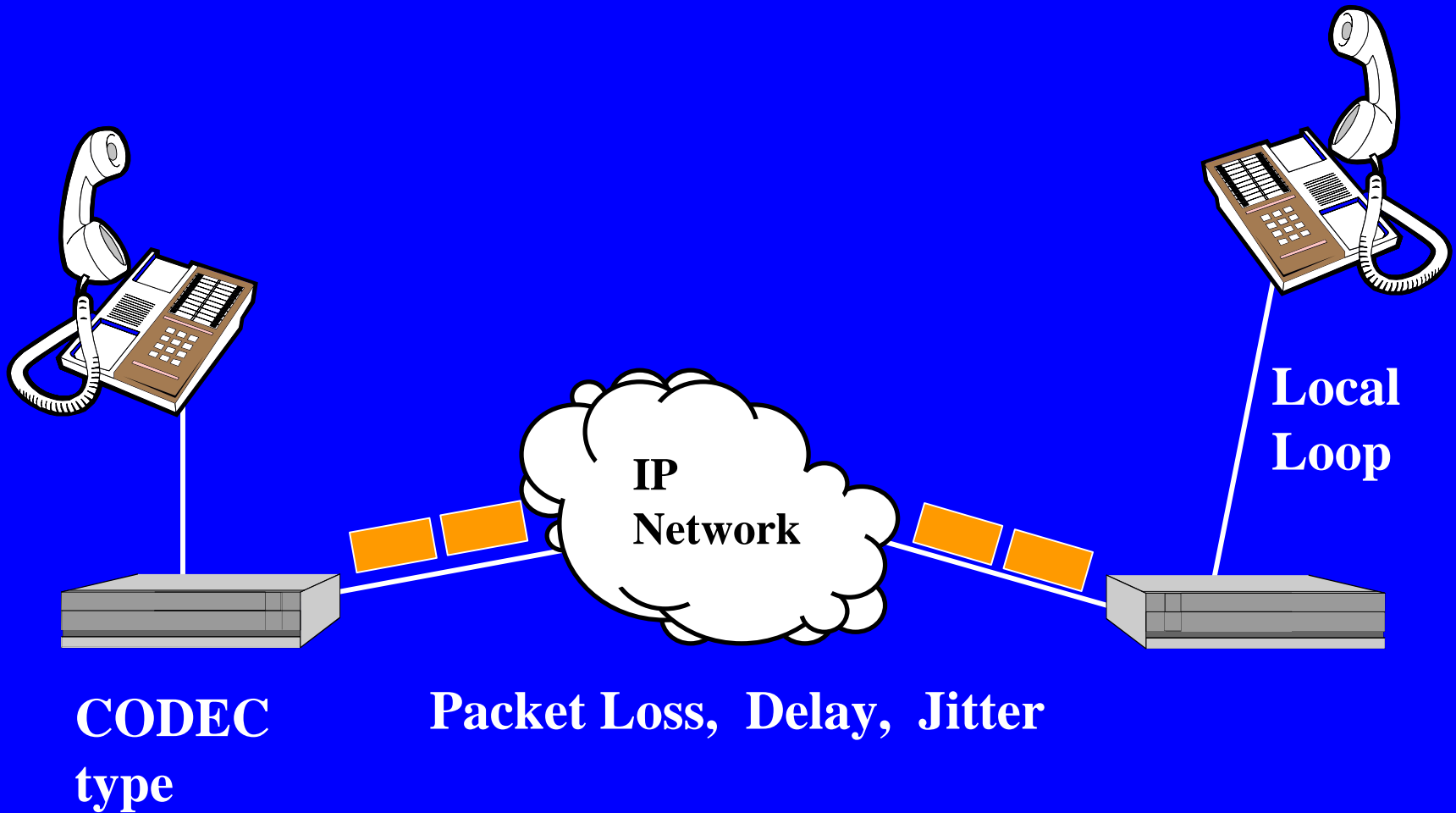
In Service Monitoring



Packet switched model



Factors affecting VoIP Service Quality



What is Subjective Quality?

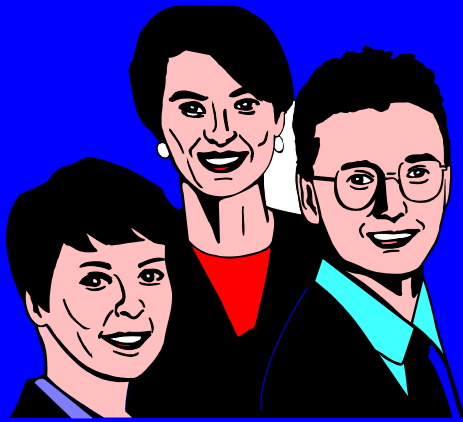


Listening Quality - call clarity and presence/absence of disturbing effects

Conversational Quality - degree to which connection supports or interferes with easy conversational dialog

Also include network impairments - call attempt fails, post dial delay.....

Measuring Subjective Quality



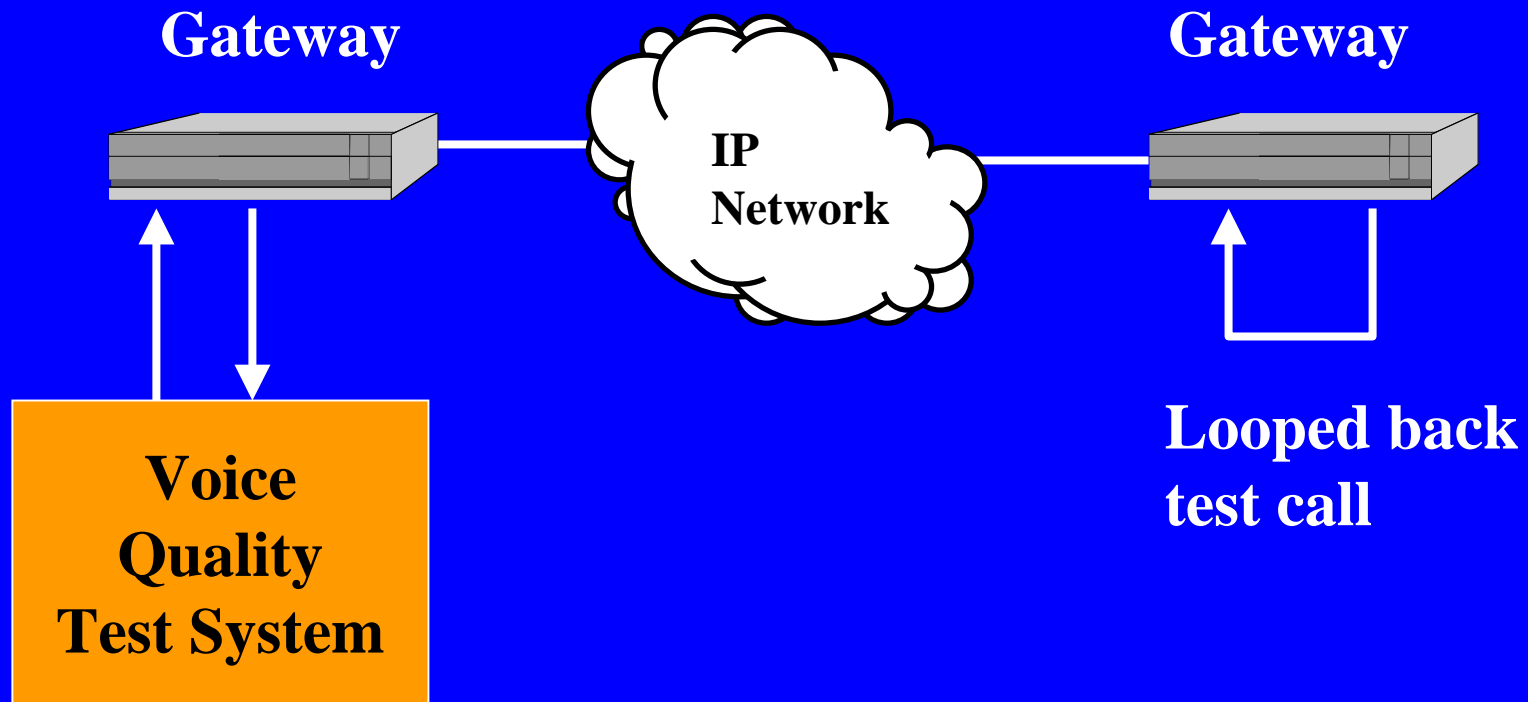
**Test group
listen to speech
samples and
classify**

Absolute Category Rating (ACR) scale

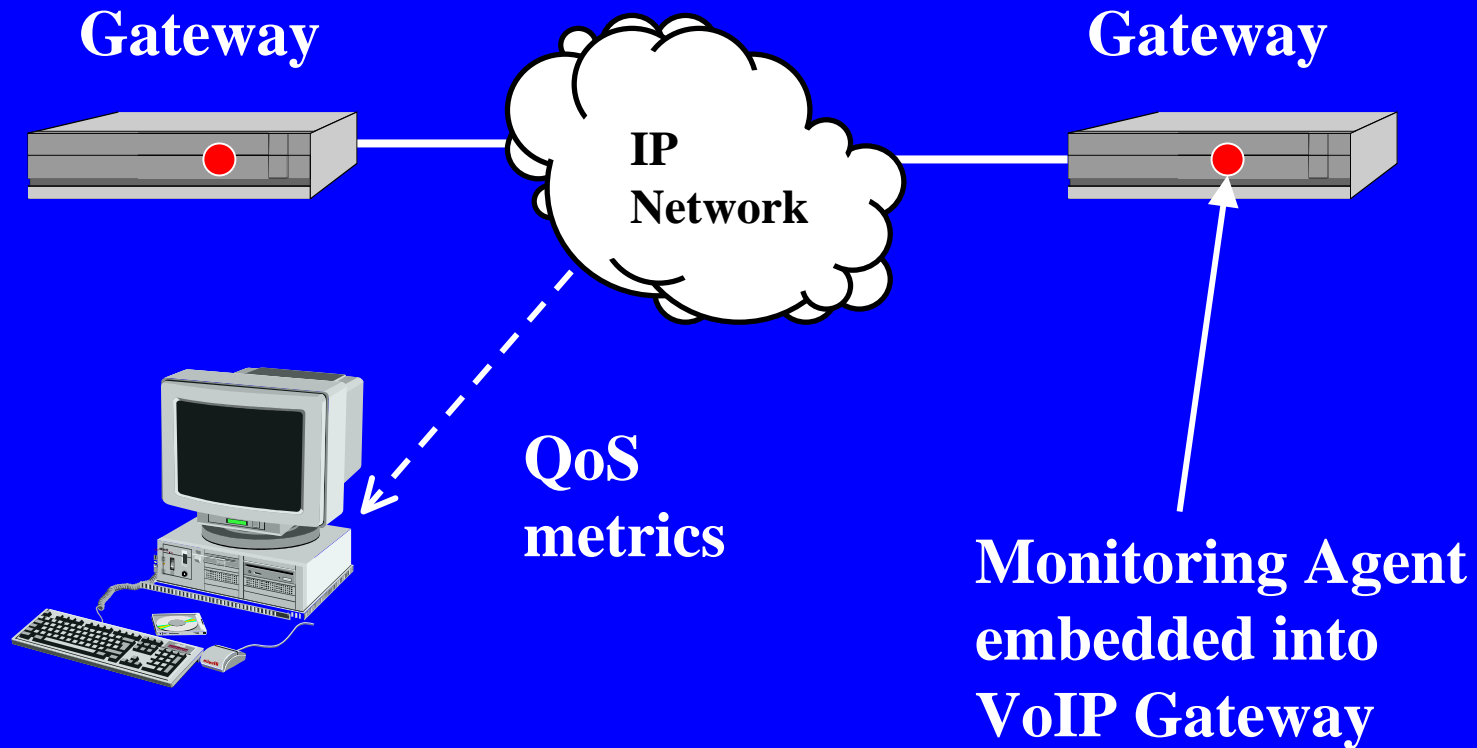
5	Excellent
4	Good
3	Fair
2	Poor
1	Bad

**Average value
=
Mean Opinion
Score (MOS)
1.0 5.0**

Active Testing- PSQM and PESQ



Embedded Passive Monitoring



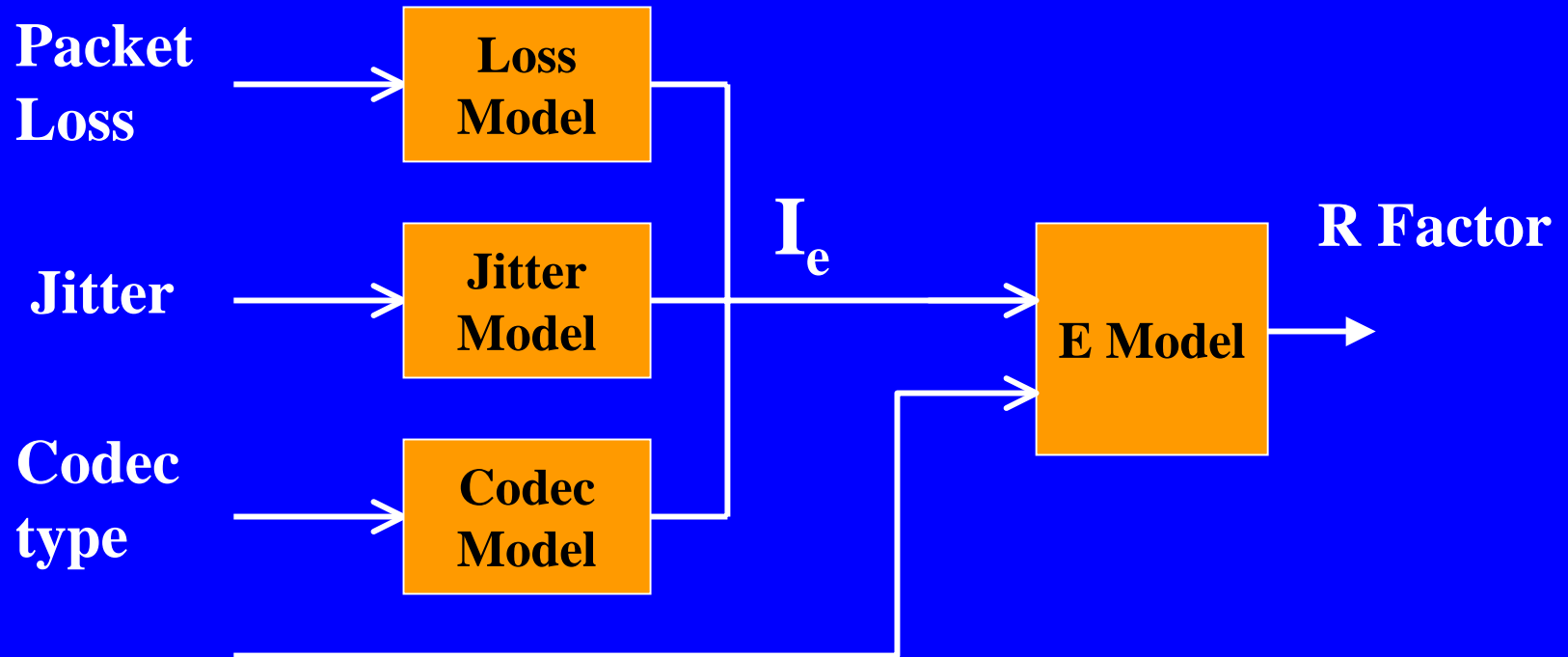
Active vs Passive Testing

- **Active Measurement**
 - Establish looped back test call
 - Send recorded speech file
 - Compare sent and received files (PSQM/PESQ)
- **Passive Monitoring**
 - Measure characteristics of live calls
 - Determine Transmission Quality metric
 - Estimate Speech Quality metrics

Embedded Passive Monitoring

- Provides per-call voice quality metric for all calls
- Does not generate additional network traffic
- Easy to add to existing IP Gateways
- Easy to integrate with existing SMS and CDR systems

E Model

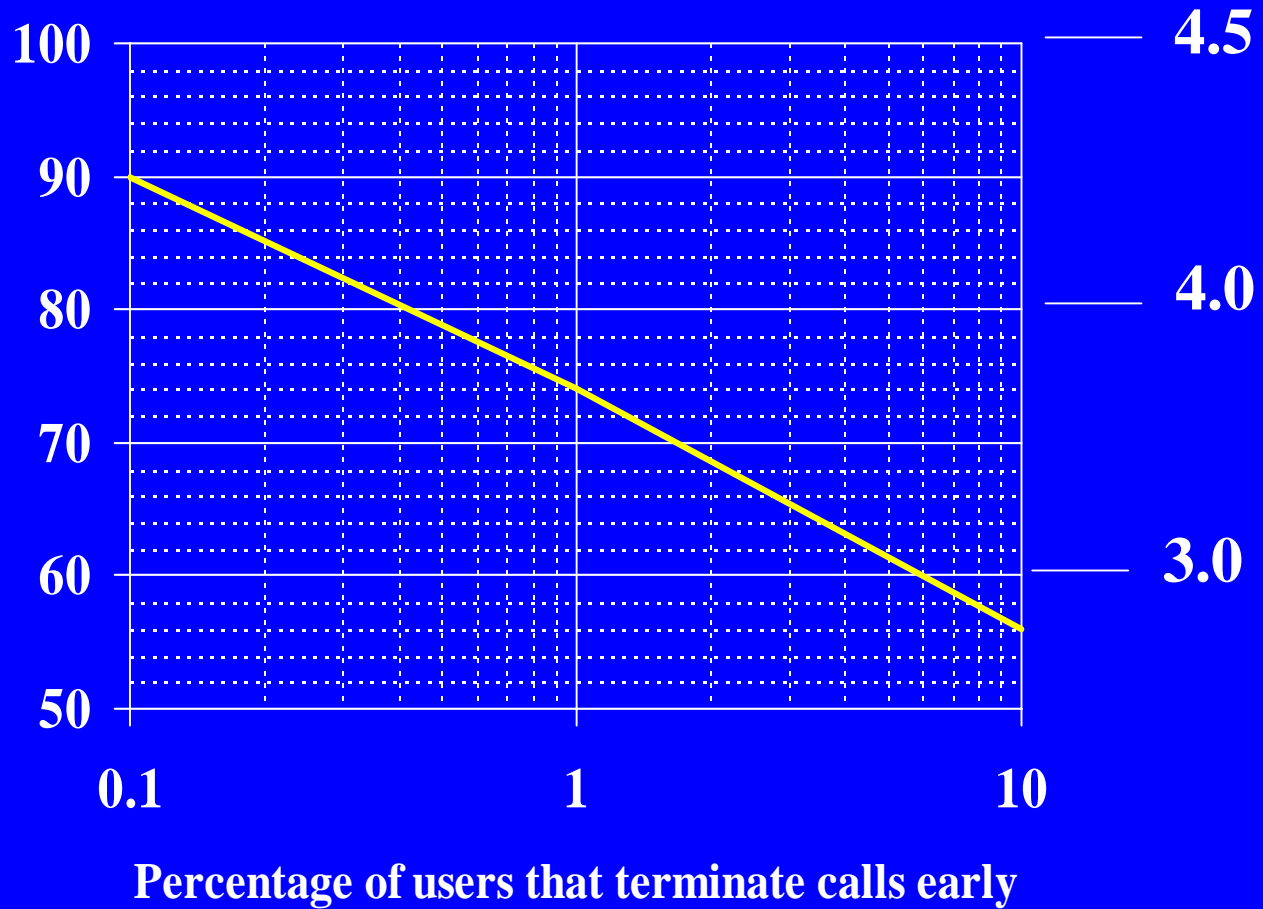


**Delay, measured
using RTCP**

R Factor vs MOS

R Factor

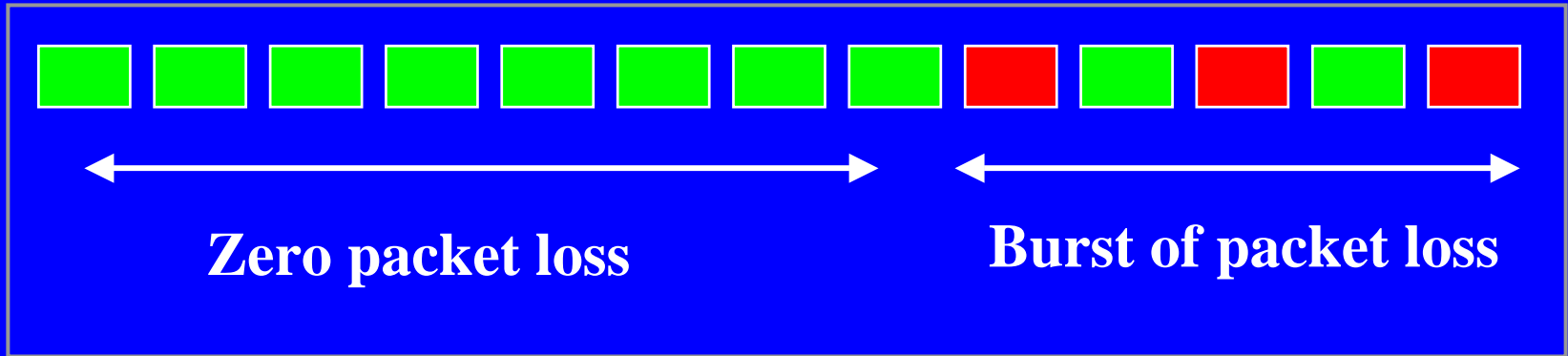
MOS



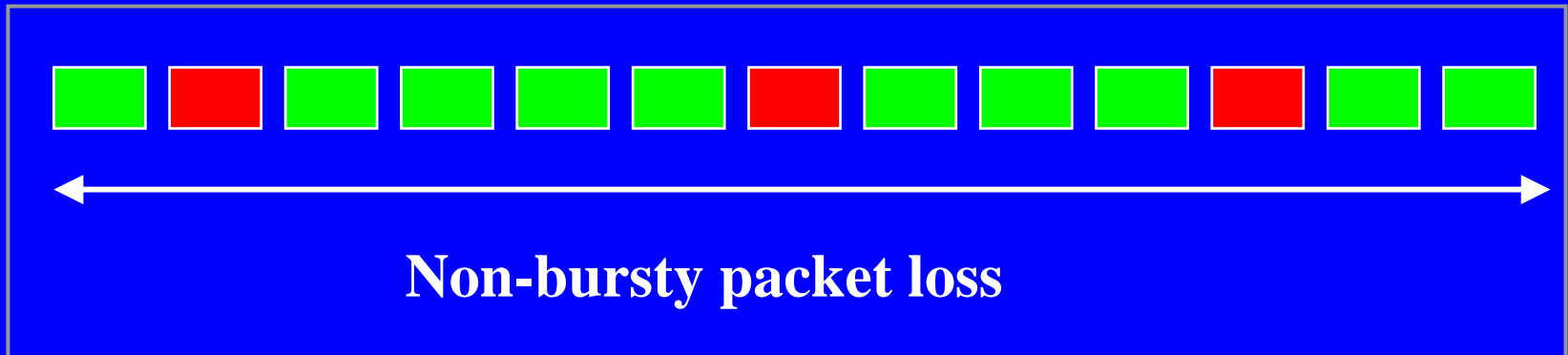
Impairments can vary with time

- Interaction of streams in IP network causes many impairments to vary with time
- Adaptive jitter buffer
- Call re-routing
- CODEC type changed during call

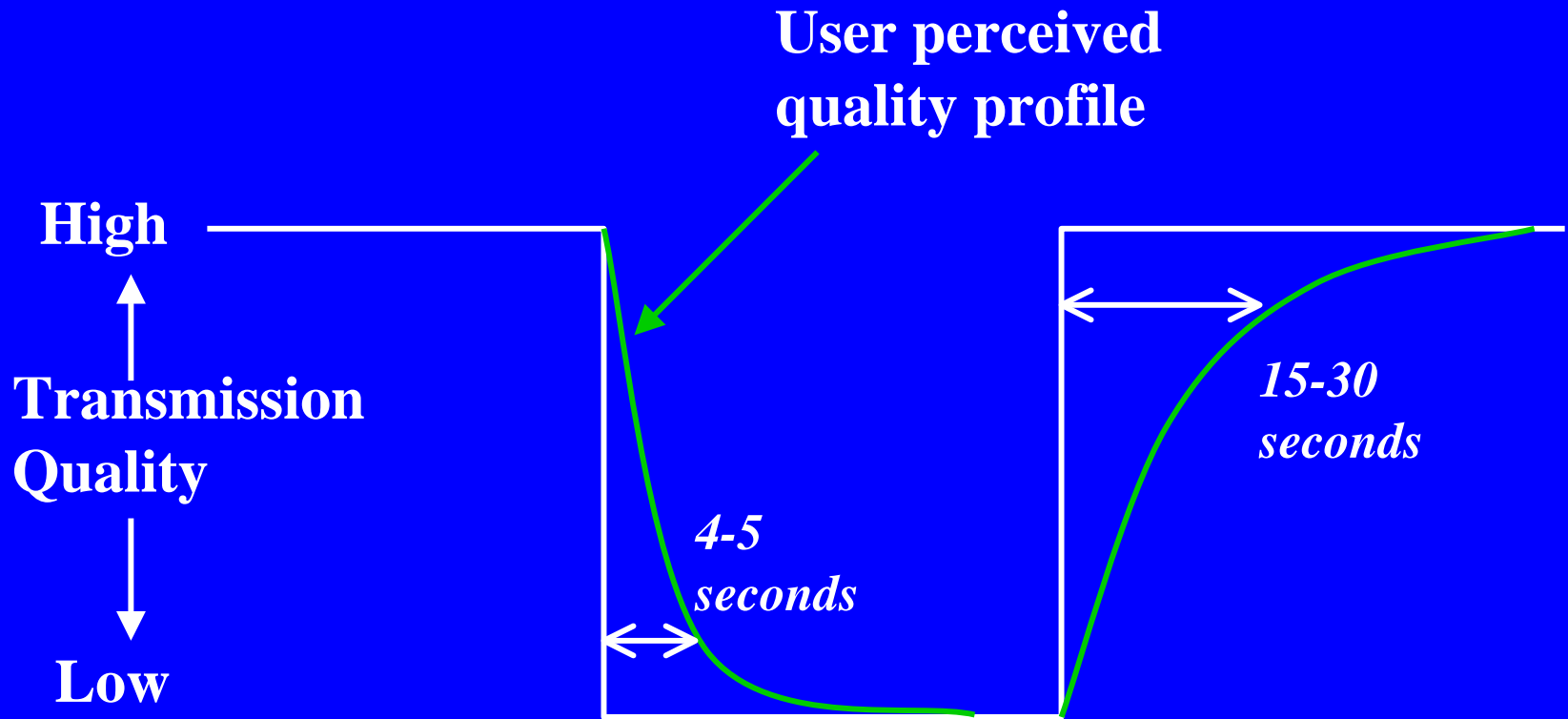
Burst vs average loss



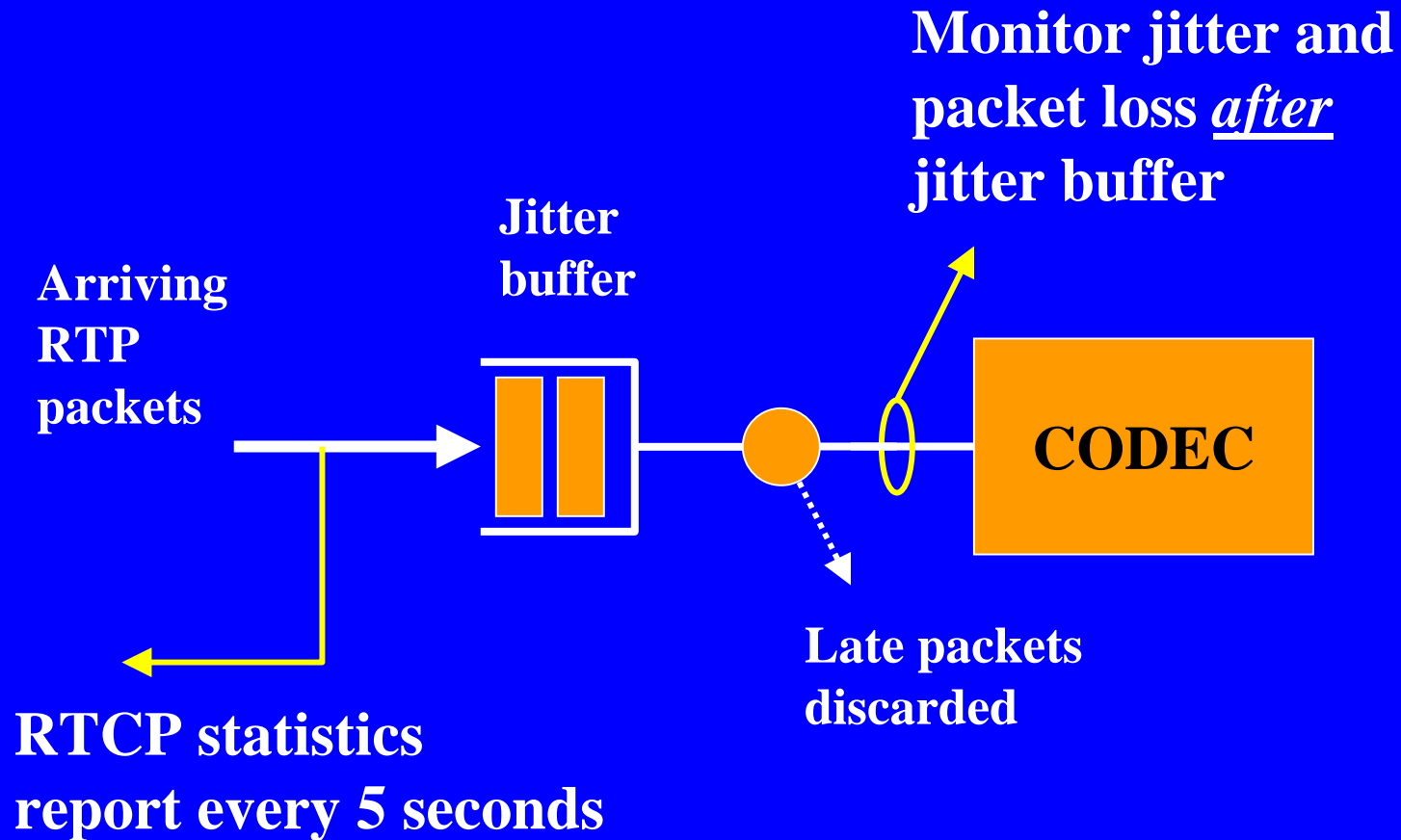
Is not the same as



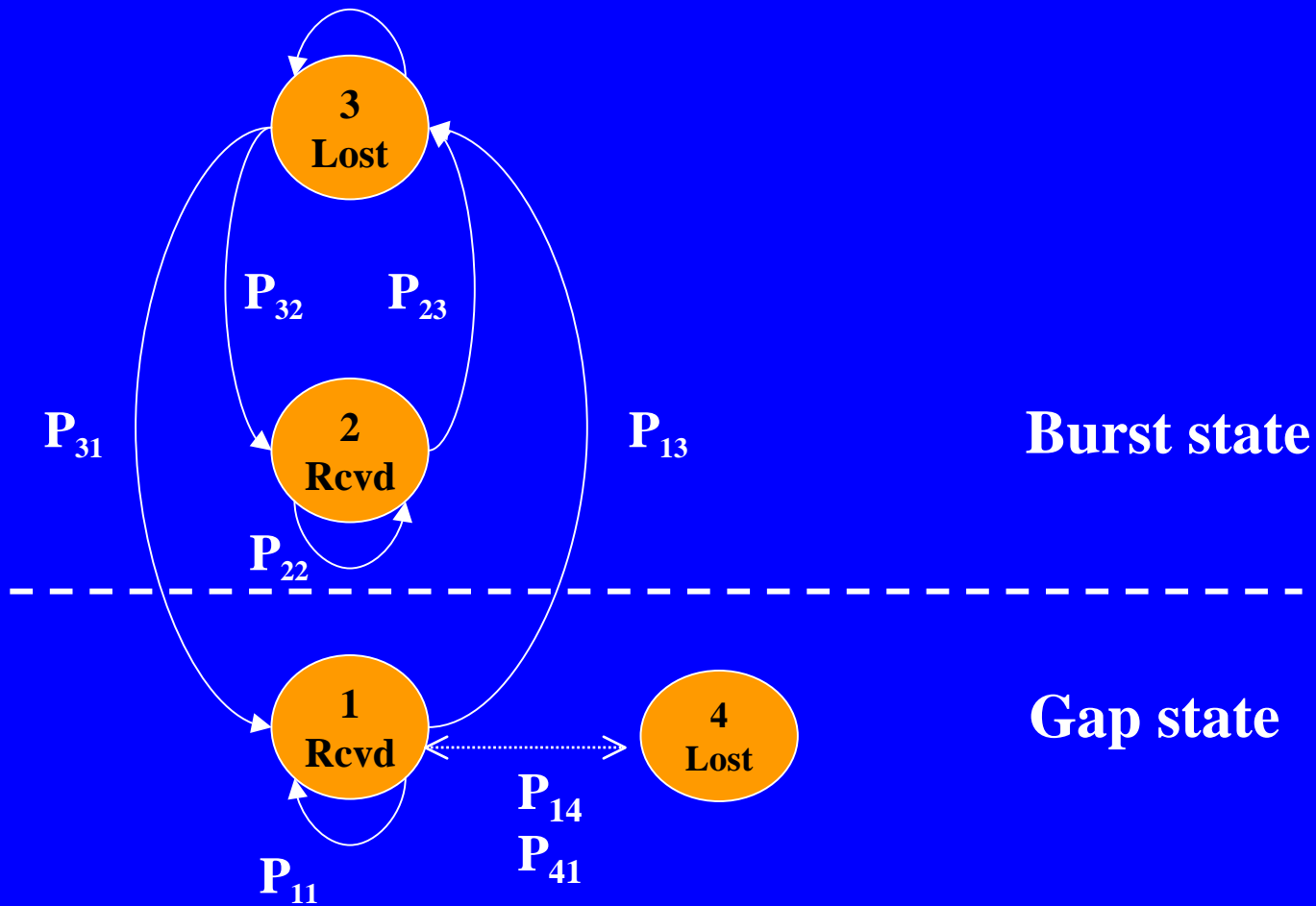
Effects of packet loss burst



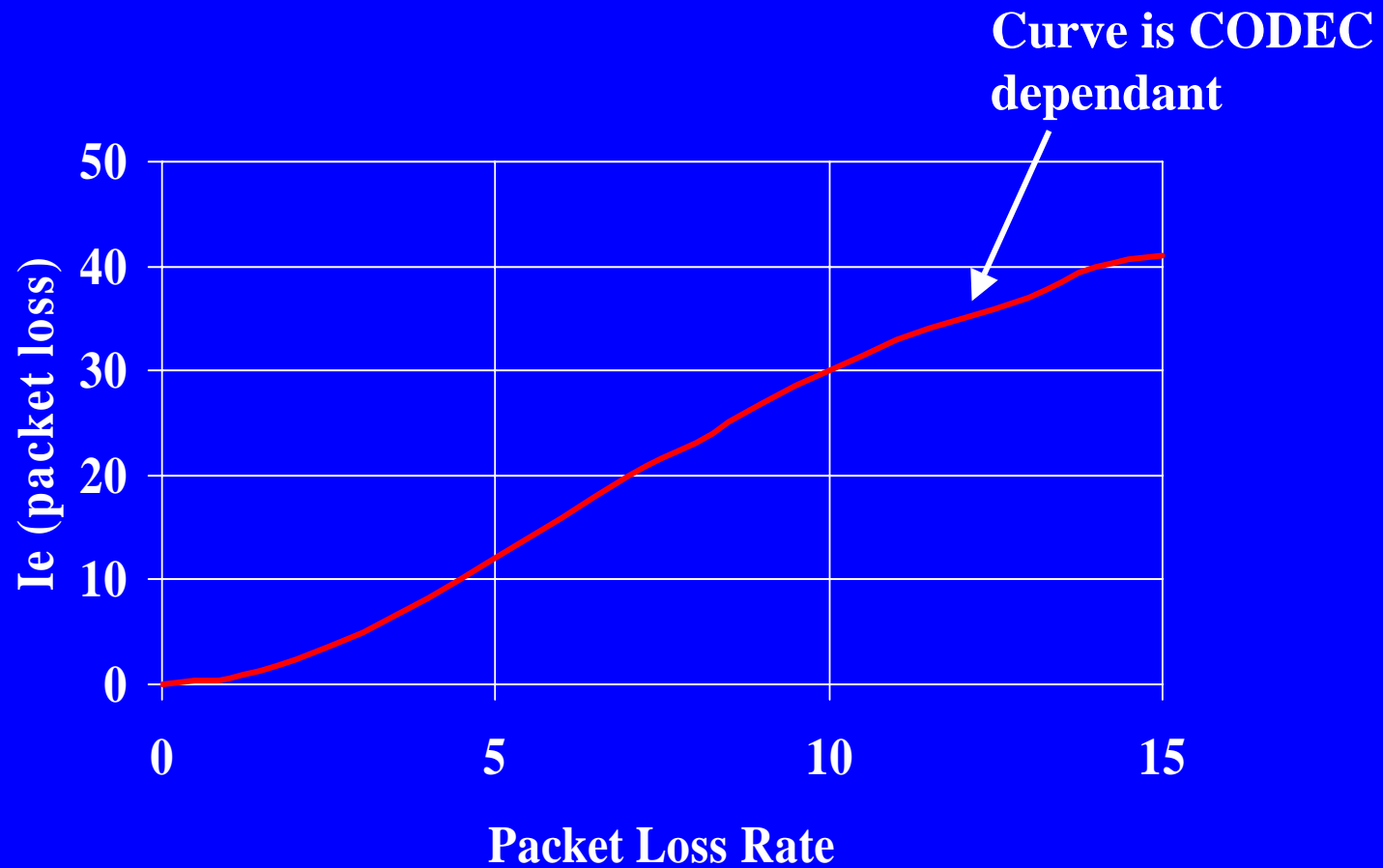
Measuring Packet Loss



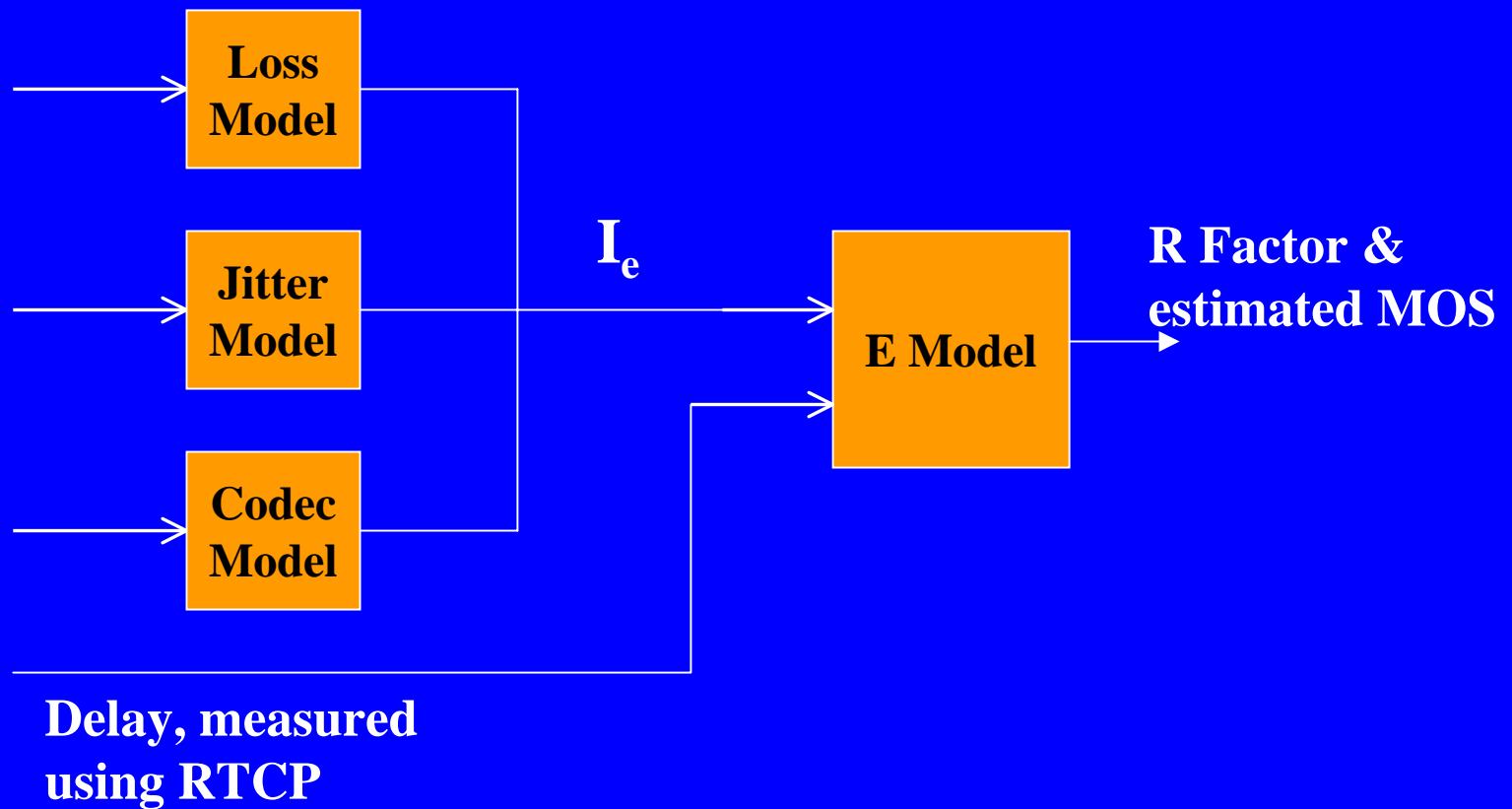
Loss Model - Markov model



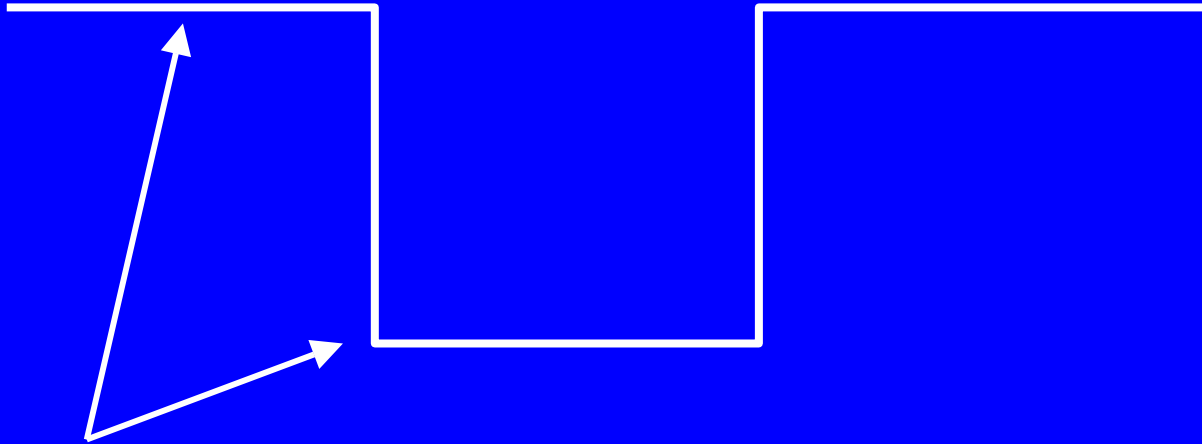
Loss Model - mapping loss to I_e



Passive monitoring

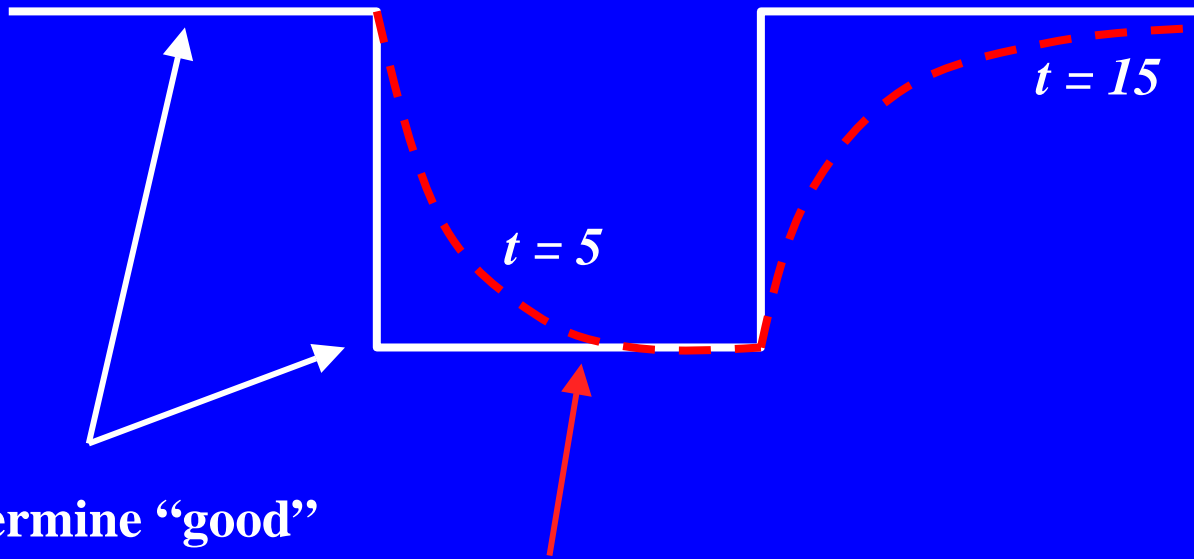


Determining QoS metrics



**1. Determine “good”
and “bad” state
Ie Factor**

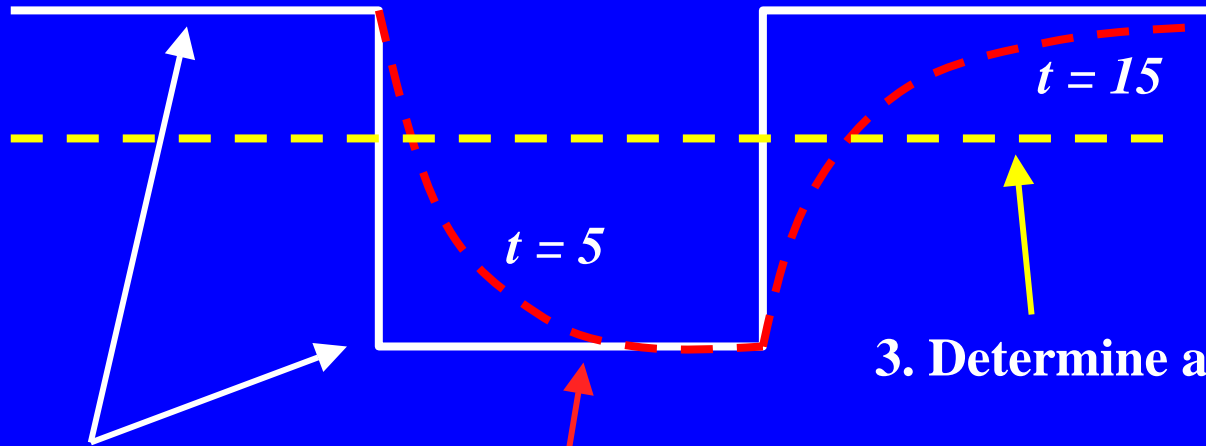
Determining QoS metrics



**1. Determine “good”
and “bad” state
Ie Factor**

**2. Estimate
Instantaneous
R Factor for
each state**

Determining QoS metrics



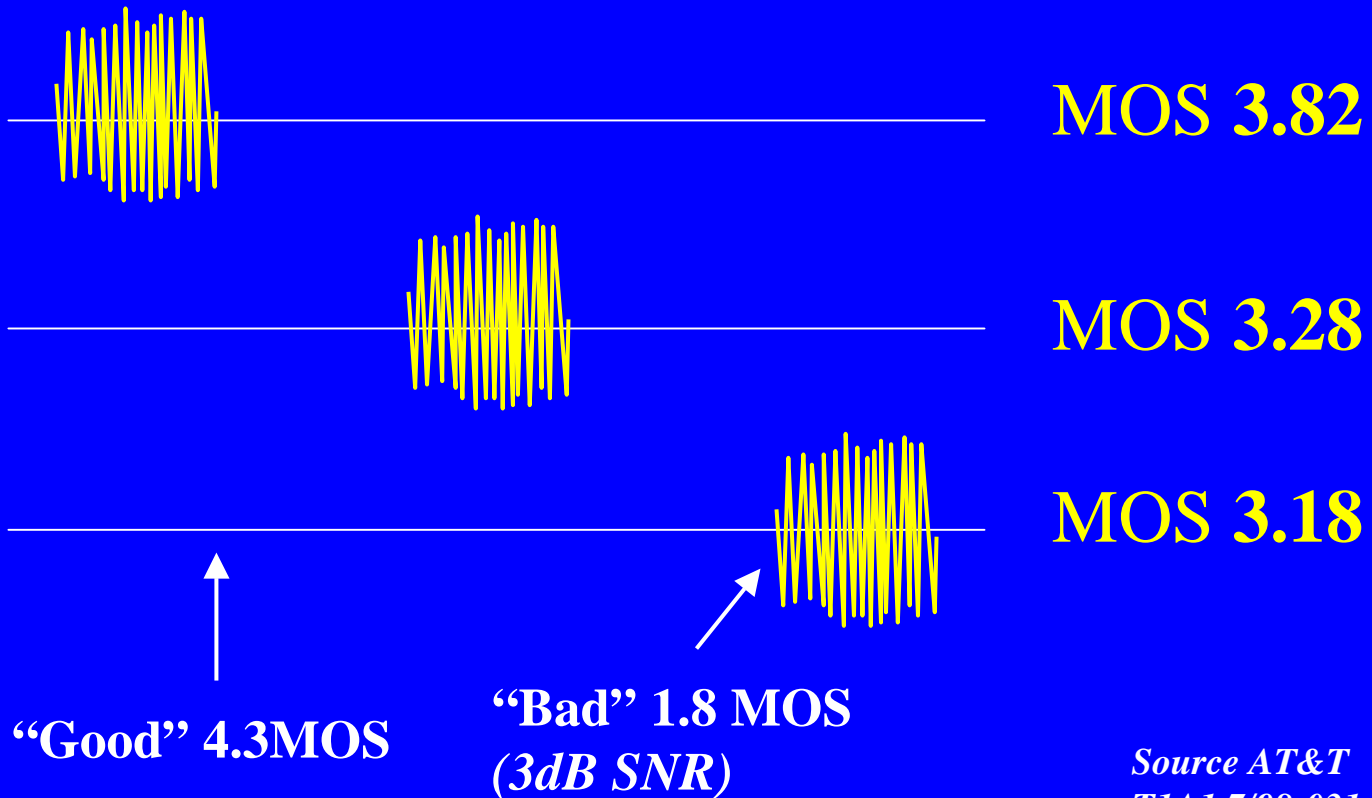
**1. Determine “good”
and “bad” state
Ie Factor**

**2. Estimate
Instantaneous
R Factor for
each state**

3. Determine average Ie

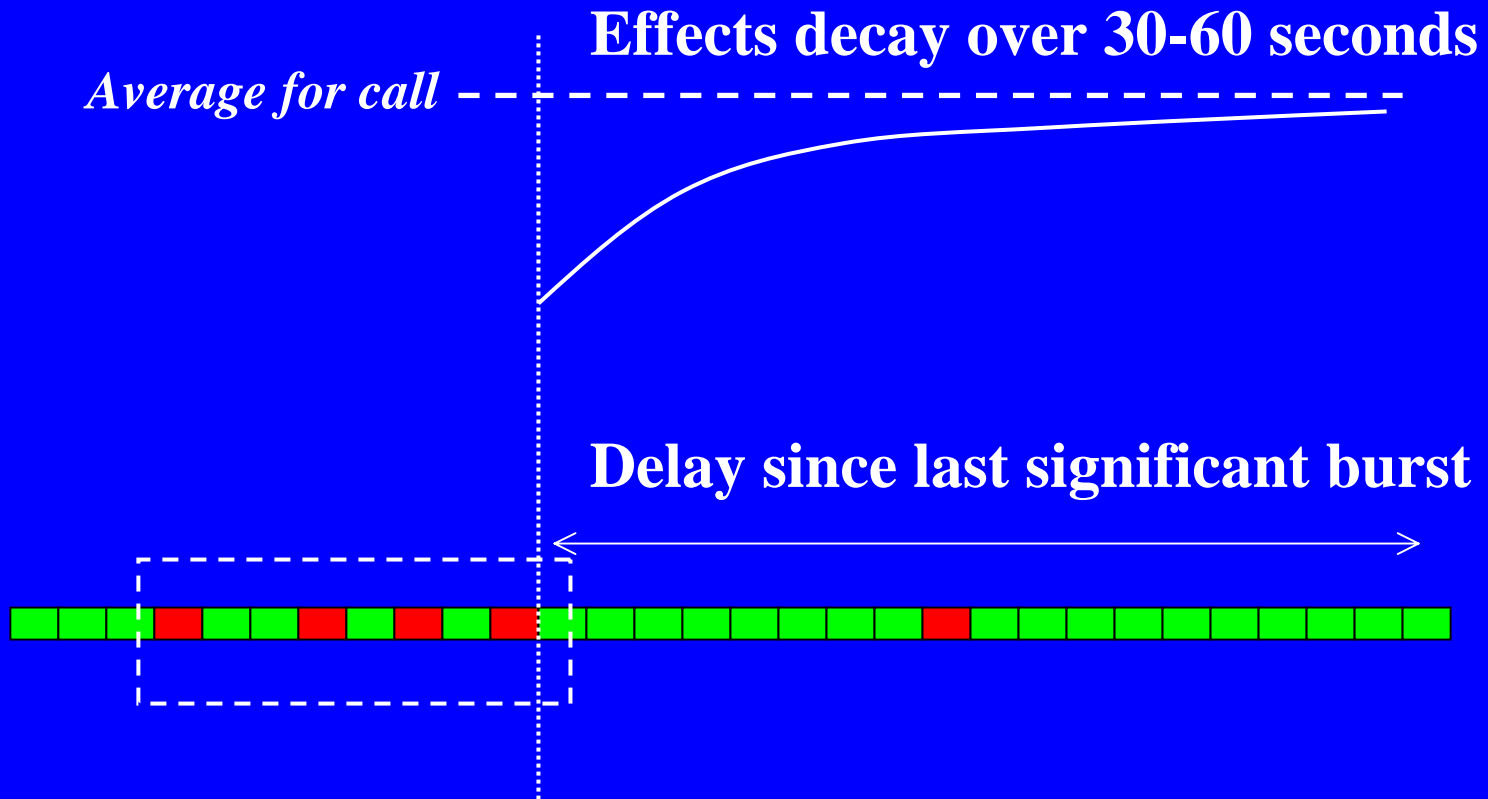
“Recency” effect

60 second call

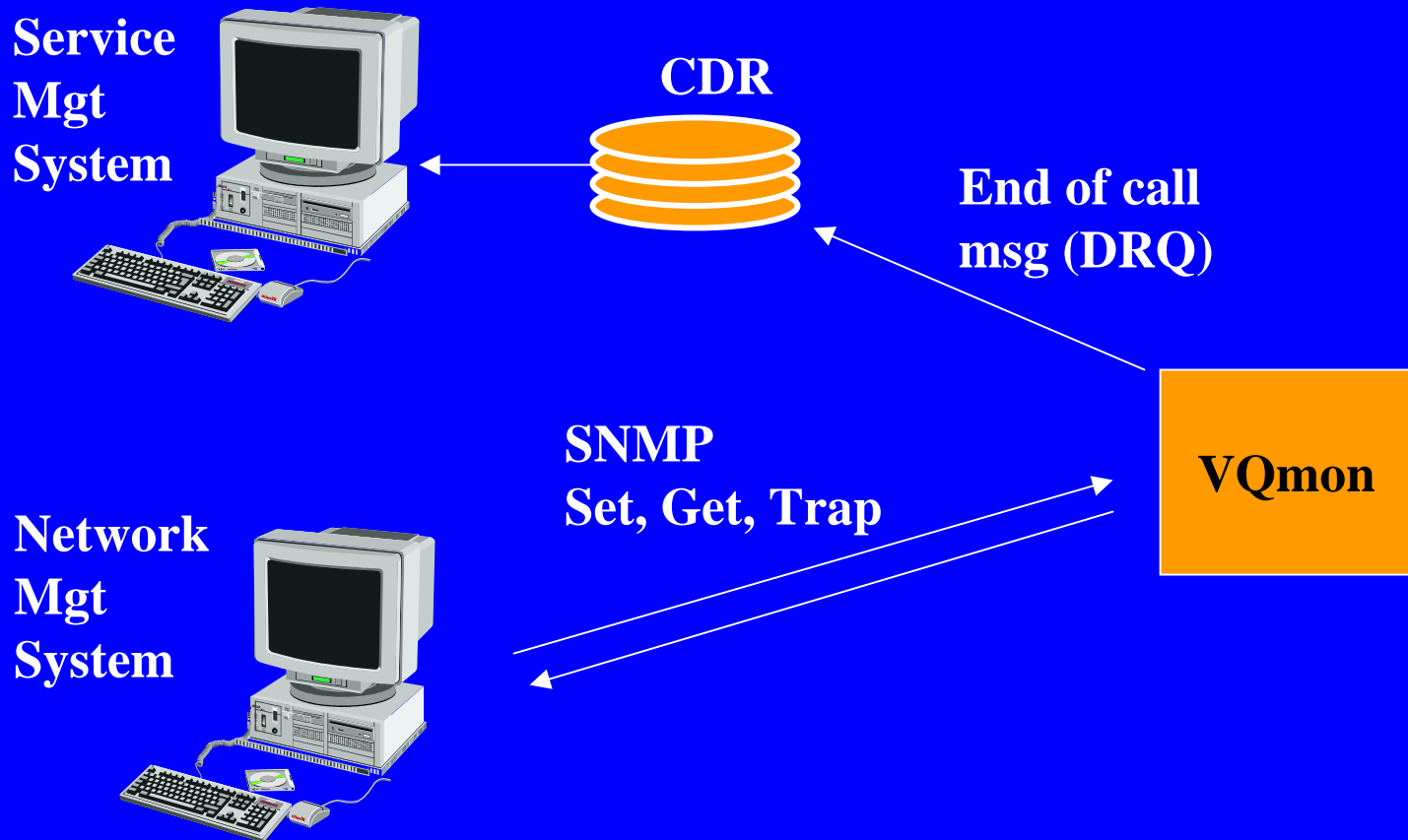


Source AT&T
TIA1.7/98-031

Estimation of recency effect



Integration with VoIP SMS



Embedded Passive Monitoring

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