Anhang 4

Graphische Darstellung der Paketloss Messungen

```
setwd("/home/lisa/Darmstadt/05_Speicher und Datennetze IoT/Praktikum/Git/mqtt-qos-rountrip/R_Analysis/0
options(digits.secs=3) # needs to be set from time to time - otherwise R doesn't allow for ms
library("data.table", lib.loc="~/R/x86_64-pc-linux-gnu-library/3.4")
library("h2o", lib.loc="~/R/x86_64-pc-linux-gnu-library/3.4")
library("tidyr", lib.loc="~/R/x86_64-pc-linux-gnu-library/3.4")
library("plyr")
library(kableExtra)

load("./latenzPL1proz.Rda")
load("./latenzPL5proz.Rda")
load("./latenzPL10proz.Rda")
load("./latenzPL15proz.Rda")
load("./latenzPL20proz.Rda")
load("./latenzPL25proz.Rda")
load("./latenzPL30proz.Rda")
```

```
#files <- list.files(pattern = "*bps.Rda", full.names = TRUE, recursive = FALSE)
files <- c("latenzPL1proz", "latenzPL5proz", "latenzPL10proz", "latenzPL15proz", "latenzPL20proz", "late
```

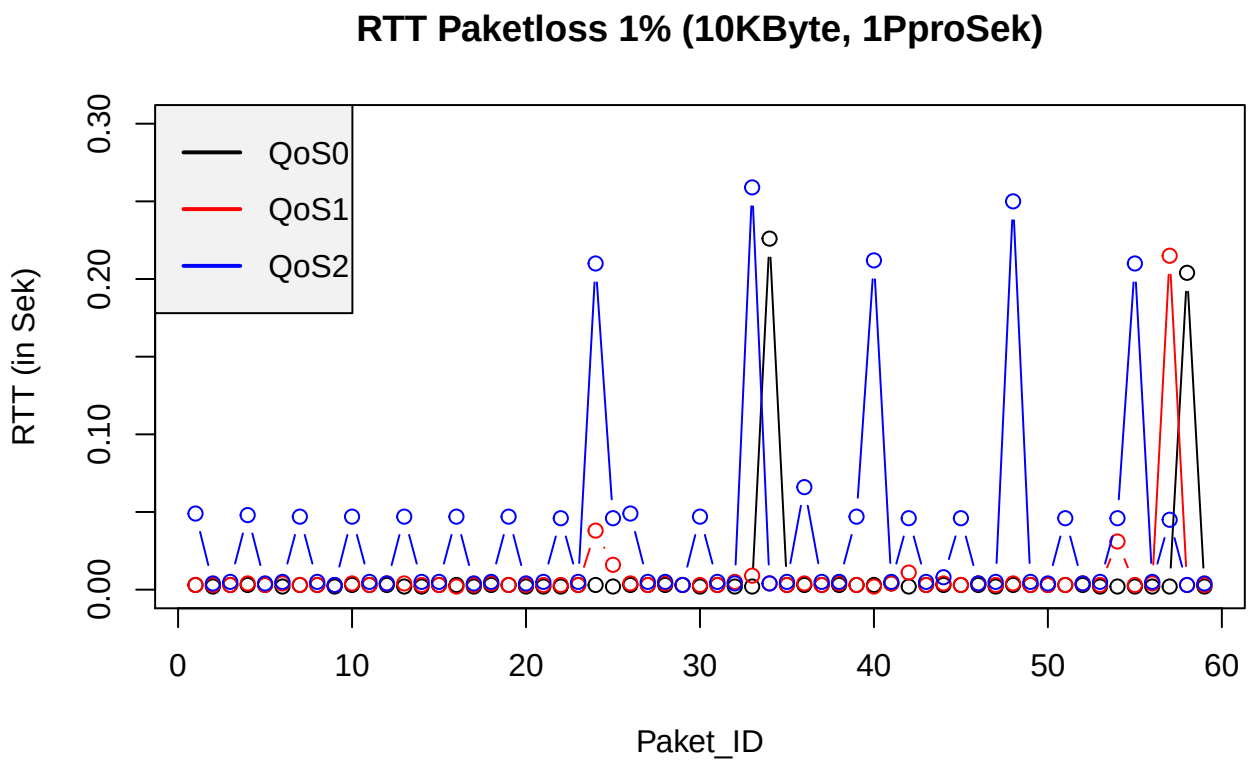
Zusammenfügn eines großen Datensatzes aller Paketloss-files

```
latenzPL1proz$PL_Proz <- 1
latenzPL5proz$PL_Proz <- 5
latenzPL10proz$PL_Proz <- 10
latenzPL15proz$PL_Proz <- 15
latenzPL20proz$PL_Proz <- 20
latenzPL25proz$PL_Proz <- 25
latenzPL30proz$PL_Proz <- 30


PLoss_Logs <- rbind(latenzPL1proz, latenzPL5proz, latenzPL10proz, latenzPL15proz, latenzPL20proz, latenz
```

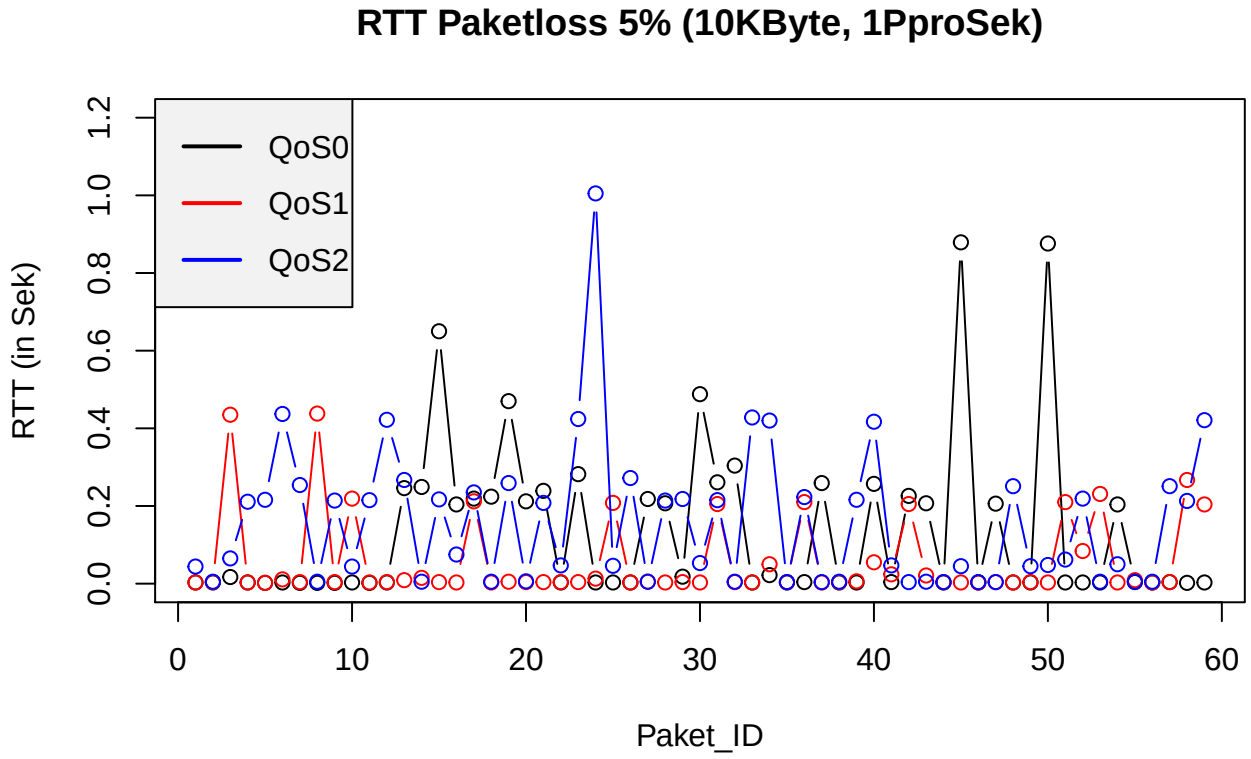
```
########################
# Aufsplittung nach PL #
########################

PLoss_Logs_1PL<-PLoss_Logs[PLoss_Logs$PL_Proz == 1,]
PLoss_Logs_5PL<-PLoss_Logs[PLoss_Logs$PL_Proz == 5,]
PLoss_Logs_10PL<-PLoss_Logs[PLoss_Logs$PL_Proz == 10,]
PLoss_Logs_15PL<-PLoss_Logs[PLoss_Logs$PL_Proz == 15,]
PLoss_Logs_20PL<-PLoss_Logs[PLoss_Logs$PL_Proz == 20,]
PLoss_Logs_25PL<-PLoss_Logs[PLoss_Logs$PL_Proz == 25,]
PLoss_Logs_30PL<-PLoss_Logs[PLoss_Logs$PL_Proz == 30,]
```

```
############################
# Aufsplittung PL nach QoS #
############################

PLoss_Logs_1PL_QoS0<-PLoss_Logs_1PL[PLoss_Logs_1PL$QoS == "qos0",]
PLoss_Logs_1PL_QoS1<-PLoss_Logs_1PL[PLoss_Logs_1PL$QoS == "qos1",]
PLoss_Logs_1PL_QoS2<-PLoss_Logs_1PL[PLoss_Logs_1PL$QoS == "qos2",]
```

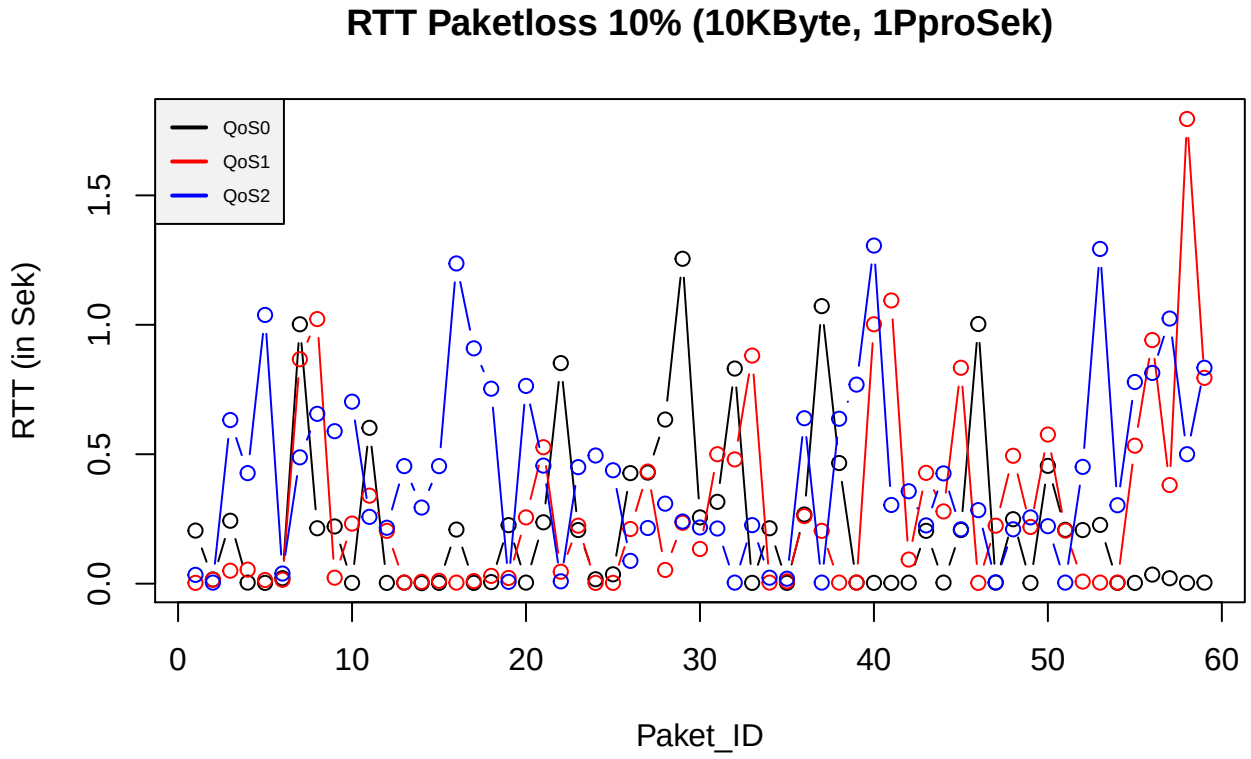
```
PLoss_Logs_5PL_QoS0<-PLoss_Logs_5PL[PLoss_Logs_5PL$QoS == "qos0",]
PLoss_Logs_5PL_QoS1<-PLoss_Logs_5PL[PLoss_Logs_5PL$QoS == "qos1",]
PLoss_Logs_5PL_QoS2<-PLoss_Logs_5PL[PLoss_Logs_5PL$QoS == "qos2",]

PLoss_Logs_10PL_QoS0<-PLoss_Logs_10PL[PLoss_Logs_10PL$QoS == "qos0",]
PLoss_Logs_10PL_QoS1<-PLoss_Logs_10PL[PLoss_Logs_10PL$QoS == "qos1",]
PLoss_Logs_10PL_QoS2<-PLoss_Logs_10PL[PLoss_Logs_10PL$QoS == "qos2",]

PLoss_Logs_15PL_QoS0<-PLoss_Logs_15PL[PLoss_Logs_15PL$QoS == "qos0",]
PLoss_Logs_15PL_QoS1<-PLoss_Logs_15PL[PLoss_Logs_15PL$QoS == "qos1",]
PLoss_Logs_15PL_QoS2<-PLoss_Logs_15PL[PLoss_Logs_15PL$QoS == "qos2",]

PLoss_Logs_20PL_QoS0<-PLoss_Logs_20PL[PLoss_Logs_20PL$QoS == "qos0",]
PLoss_Logs_20PL_QoS1<-PLoss_Logs_20PL[PLoss_Logs_20PL$QoS == "qos1",]
PLoss_Logs_20PL_QoS2<-PLoss_Logs_20PL[PLoss_Logs_20PL$QoS == "qos2",]

PLoss_Logs_25PL_QoS0<-PLoss_Logs_25PL[PLoss_Logs_25PL$QoS == "qos0",]
PLoss_Logs_25PL_QoS1<-PLoss_Logs_25PL[PLoss_Logs_25PL$QoS == "qos1",]
PLoss_Logs_25PL_QoS2<-PLoss_Logs_25PL[PLoss_Logs_25PL$QoS == "qos2",]

PLoss_Logs_30PL_QoS0<-PLoss_Logs_30PL[PLoss_Logs_30PL$QoS == "qos0",]
PLoss_Logs_30PL_QoS1<-PLoss_Logs_30PL[PLoss_Logs_30PL$QoS == "qos1",]
PLoss_Logs_30PL_QoS2<-PLoss_Logs_30PL[PLoss_Logs_30PL$QoS == "qos2",]

#rttQoS0<-get(namesTime[1])
#rttQoS1<-get(namesTime[2])
#rttQoS2<-get(namesTime[3])

par(mfrow = c(1, 1))
######
# 1% #
######
plot(PLoss_Logs_1PL_QoS0$id, PLoss_Logs_1PL_QoS0$rtt, main = "RTT Paketloss 1% (10KByte, 1PproSek)",
     ylim = c(0, 0.3), ylab = "RTT (in Sek)", xlab = "Paket_ID", type = "b")
points(PLoss_Logs_1PL_QoS1$id, PLoss_Logs_1PL_QoS1$rtt, col = "red", type = "b")
points(PLoss_Logs_1PL_QoS2$id, PLoss_Logs_1PL_QoS2$rtt, col = "blue", type = "b")

legend("topleft", c("QoS0", "QoS1", "QoS2"), text.width = 4,
       col = c("black", "red", "blue"),
       text.col = "black", cex = 1  ,lwd = c(2, 2, 2),
       y.intersp = 1.5, merge = FALSE, bg = "gray95")
```



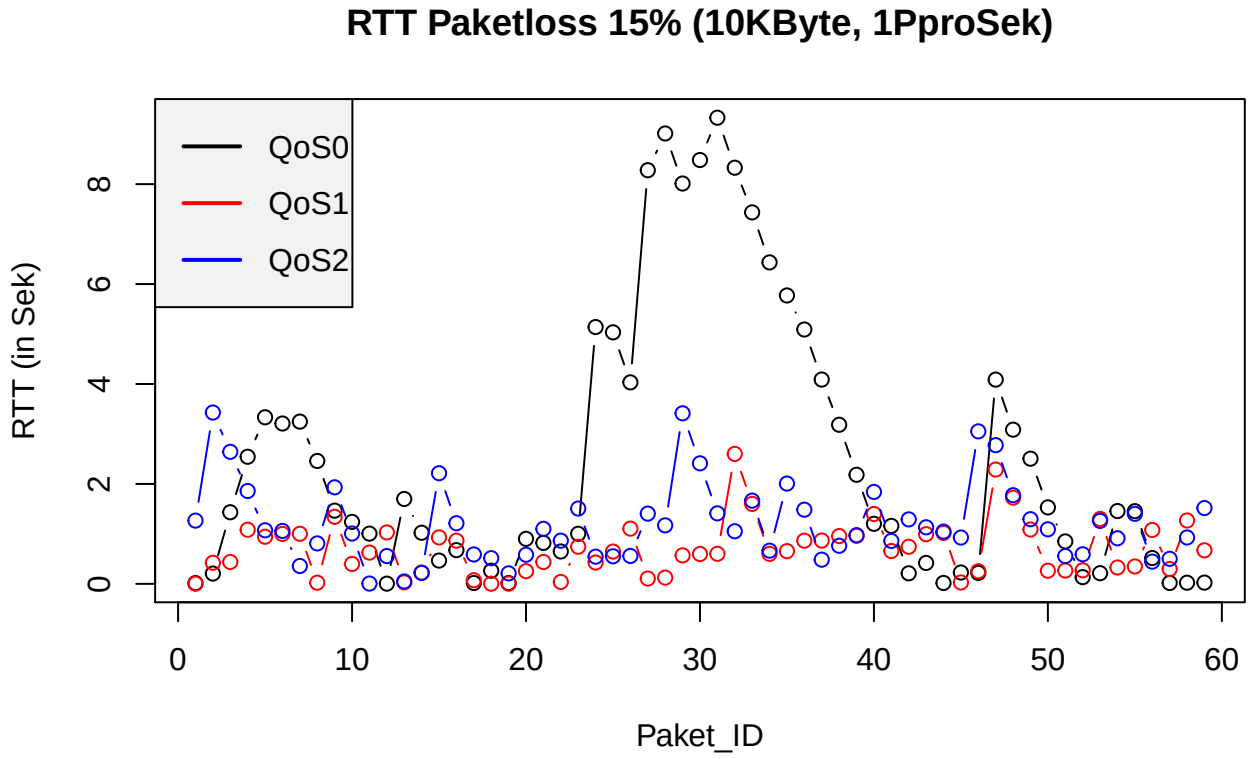

```
######
# 5% #
######
plot(PLoss_Logs_5PL_QoS0$id, PLoss_Logs_5PL_QoS0$rtt, main = "RTT Paketloss 5% (10KByte, 1PproSek)",
     ylim = c(0, 1.2), ylab = "RTT (in Sek)", xlab = "Paket_ID", type = "b")
points(PLoss_Logs_5PL_QoS1$id, PLoss_Logs_5PL_QoS1$rtt, col = "red", type = "b")
points(PLoss_Logs_5PL_QoS2$id, PLoss_Logs_5PL_QoS2$rtt, col = "blue", type = "b")

legend("topleft", c("QoS0", "QoS1", "QoS2"), text.width = 4,
       col = c("black", "red", "blue"),
       text.col = "black", cex = 1  ,lwd = c(2, 2, 2),
       y.intersp = 1.5, merge = FALSE, bg = "gray95")
```



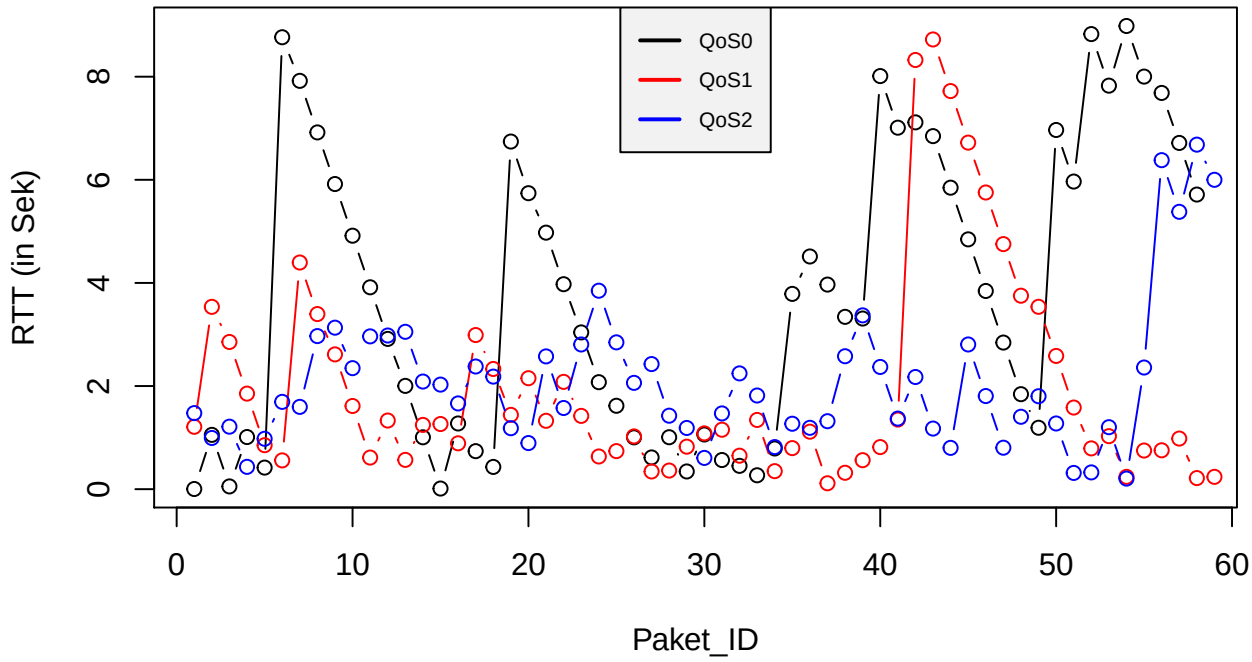

```
#######
# 10% #
#######
plot(PLoss_Logs_10PL_QoS0$id, PLoss_Logs_10PL_QoS0$rtt, main = "RTT Paketloss 10% (10KByte, 1PproSek)",
     ylim = c(0,1.8), ylab = "RTT (in Sek)", xlab = "Paket_ID", type = "b")
points(PLoss_Logs_10PL_QoS1$id, PLoss_Logs_10PL_QoS1$rtt, col = "red", type = "b")
points(PLoss_Logs_10PL_QoS2$id, PLoss_Logs_10PL_QoS2$rtt, col = "blue", type = "b")

legend("topleft", c("QoS0", "QoS1", "QoS2"), text.width = 3, cex = 0.6,
       col = c("black", "red", "blue"),
       text.col = "black", lwd = c(2, 2, 2),
       y.intersp = 1.5, merge = FALSE, bg = "gray95")
```



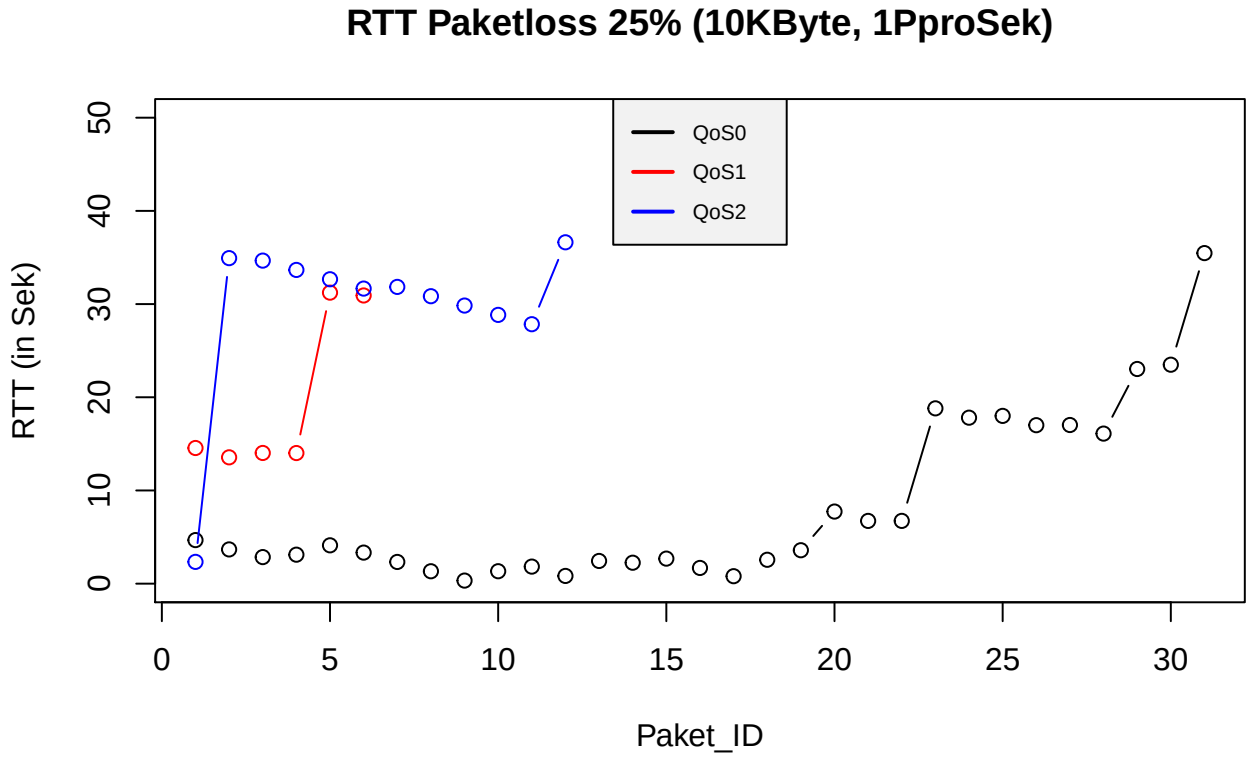

```
#######
# 15% #
#######
plot(PLoss_Logs_15PL_QoS0$id, PLoss_Logs_15PL_QoS0$rtt, main = "RTT Paketloss 15% (10KByte, 1PproSek)",
     ylab = "RTT (in Sek)", xlab = "Paket_ID", type = "b")
points(PLoss_Logs_15PL_QoS1$id, PLoss_Logs_15PL_QoS1$rtt, col = "red", type = "b")
points(PLoss_Logs_15PL_QoS2$id, PLoss_Logs_15PL_QoS2$rtt, col = "blue", type = "b")

legend("topleft", c("QoS0", "QoS1", "QoS2"), text.width = 4,
       col = c("black", "red", "blue"),
       text.col = "black", cex = 1   ,lwd = c(2, 2, 2),
       y.intersp = 1.5, merge = FALSE, bg = "gray95")
```



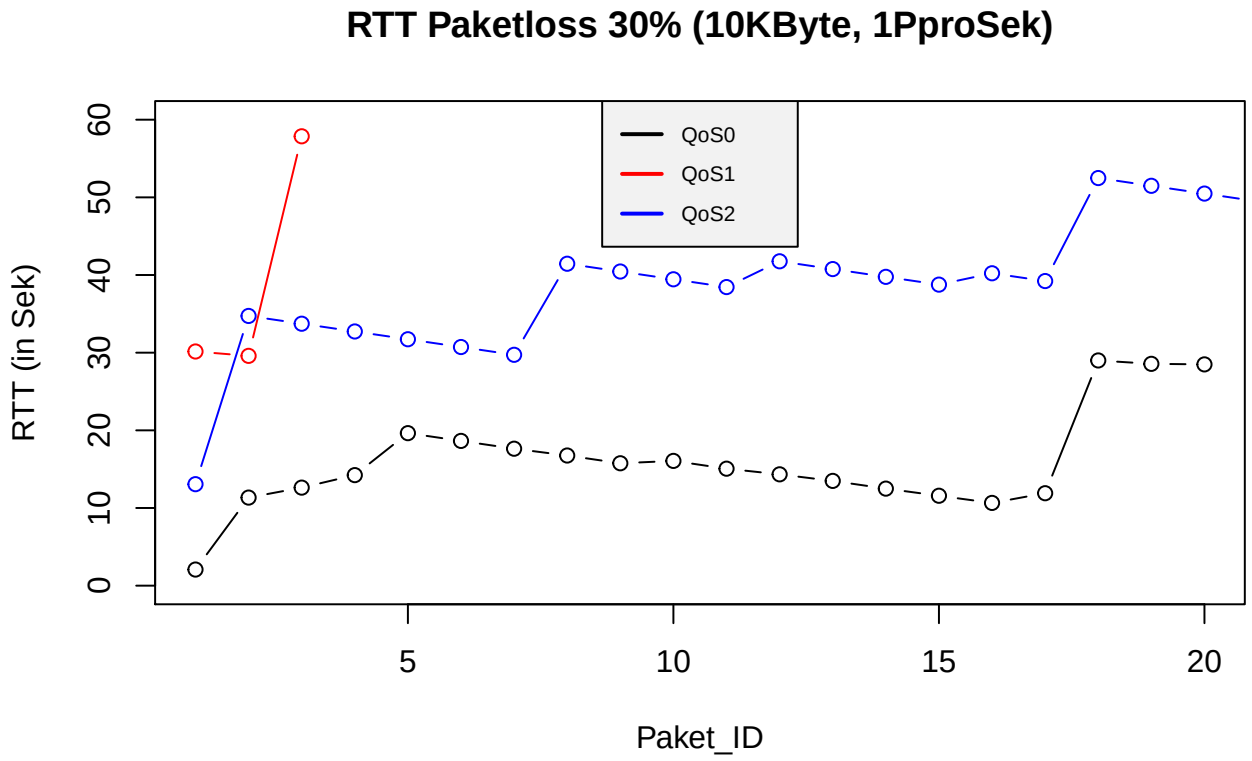

```
#######
# 20% #
#######
plot(PLoss_Logs_20PL_QoS0$id, PLoss_Logs_20PL_QoS0$rtt, main = "RTT Paketloss 20% (10KByte, 1PproSek)",
     ylab = "RTT (in Sek)", xlab = "Paket_ID", type = "b")
points(PLoss_Logs_20PL_QoS1$id, PLoss_Logs_20PL_QoS1$rtt, col = "red", type = "b")
points(PLoss_Logs_20PL_QoS2$id, PLoss_Logs_20PL_QoS2$rtt, col = "blue", type = "b")

legend("top", c("QoS0", "QoS1", "QoS2"), text.width = 3.5, cex = 0.7,
       col = c("black", "red", "blue"),
       text.col = "black", lwd = c(2, 2, 2),
       y.intersp = 1.5, merge = FALSE, bg = "gray95")
```



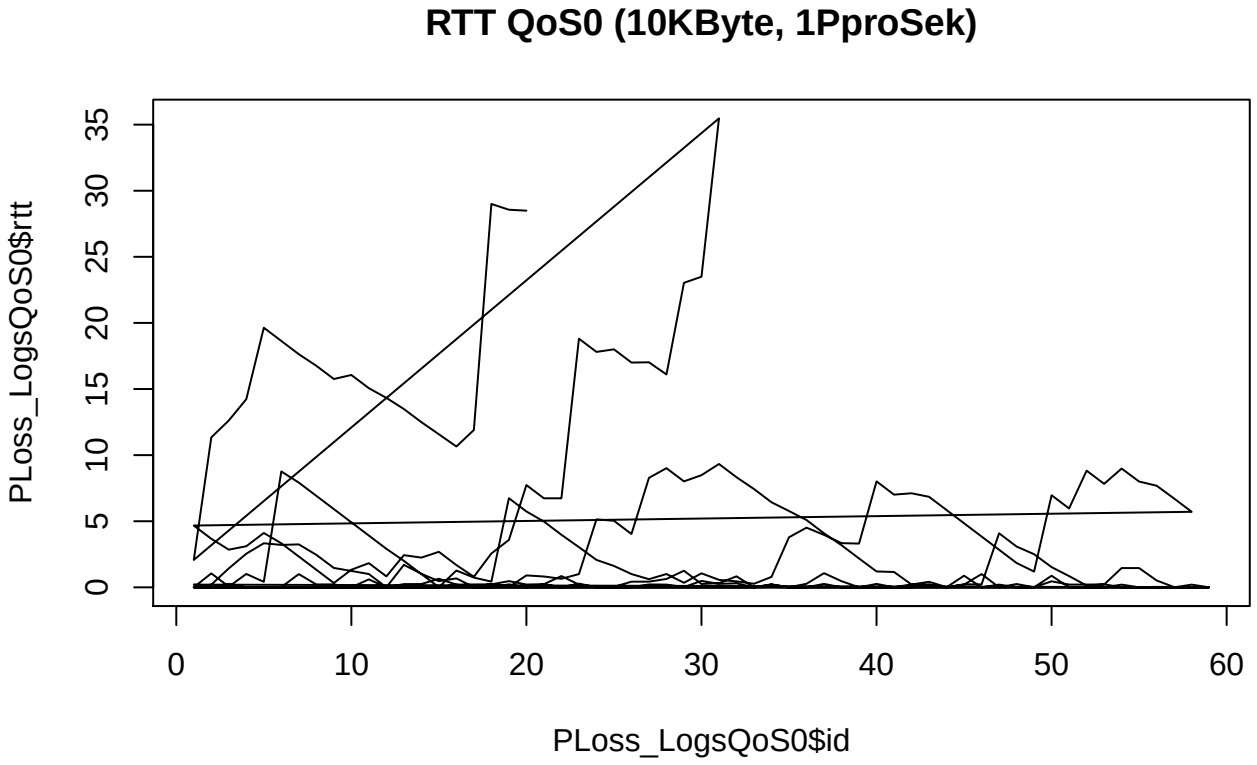

```
#######
# 25% #
#######
plot(PLoss_Logs_25PL_QoS0$id, PLoss_Logs_25PL_QoS0$rtt, main = "RTT Paketloss 25% (10KByte, 1PproSek)",
     ylim = c(0, 50), ylab = "RTT (in Sek)", xlab = "Paket_ID", type = "b")
points(PLoss_Logs_25PL_QoS1$id, PLoss_Logs_25PL_QoS1$rtt, col = "red", type = "b")
points(PLoss_Logs_25PL_QoS2$id, PLoss_Logs_25PL_QoS2$rtt, col = "blue", type = "b")

legend("top", c("QoS0", "QoS1", "QoS2"), text.width = 2.5, cex = 0.7,
       col = c("black", "red", "blue"),
       text.col = "black", lwd = c(2, 2, 2),
       y.intersp = 1.5, merge = FALSE, bg = "gray95")
```



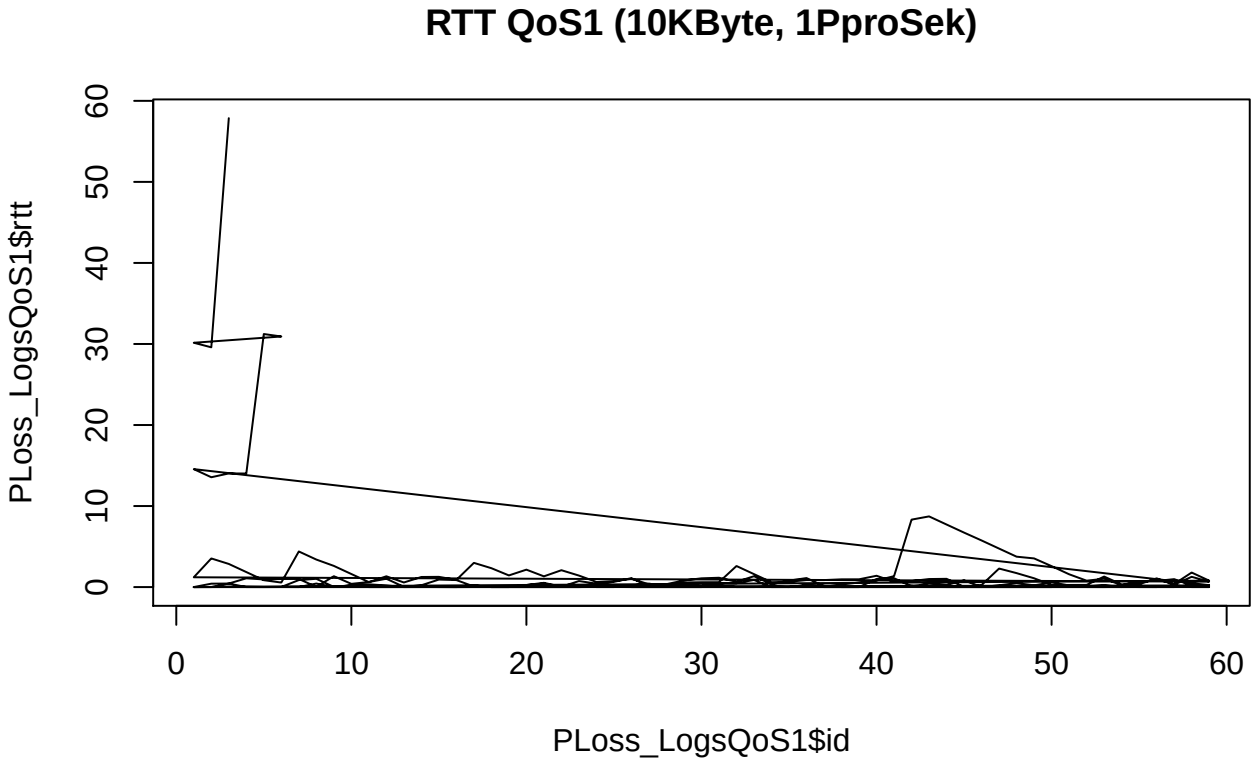

```
#######
# 30% #
#######
plot(PLoss_Logs_30PL_QoS0$id, PLoss_Logs_30PL_QoS0$rtt, main = "RTT Paketloss 30% (10KByte, 1PproSek)",
     ylim = c(0, 60), ylab = "RTT (in Sek)", xlab = "Paket_ID", type = "b")
points(PLoss_Logs_30PL_QoS1$id, PLoss_Logs_30PL_QoS1$rtt, col = "red", type = "b")
points(PLoss_Logs_30PL_QoS2$id, PLoss_Logs_30PL_QoS2$rtt, col = "blue", type = "b")

legend("top", c("QoS0", "QoS1", "QoS2"), col = c("black", "red", "blue"), text.width = 2, cex = 0.7,
       text.col = "black", lwd = c(2, 2, 2),
       y.intersp = 1.5, merge = FALSE, bg = "gray95")
```



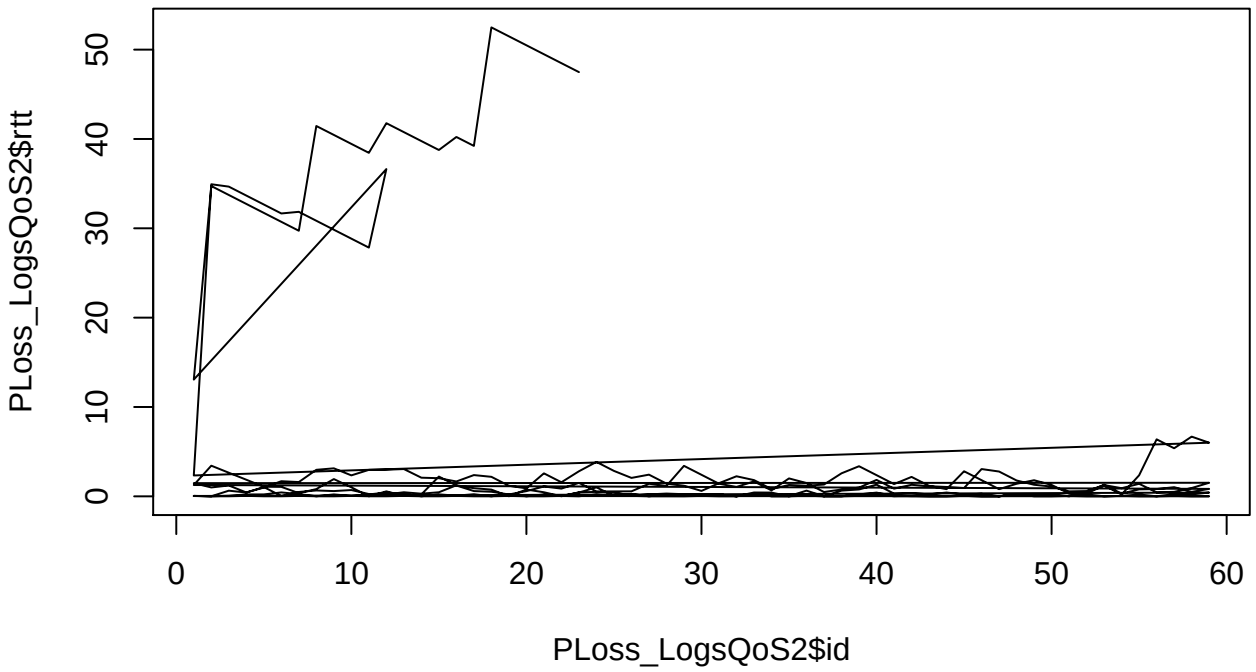

```
#########################
# Aufsplittung nach QoS #
#########################

PLoss_LogsQoS0<-PLoss_Logs[PLoss_Logs$QoS == "qos0",]
PLoss_LogsQoS1<-PLoss_Logs[PLoss_Logs$QoS == "qos1",]
PLoss_LogsQoS2<-PLoss_Logs[PLoss_Logs$QoS == "qos2",]

plot(PLoss_LogsQoS0$id, PLoss_LogsQoS0$rtt, type = "l", main = "RTT QoS0 (10KByte, 1PproSek)")
```



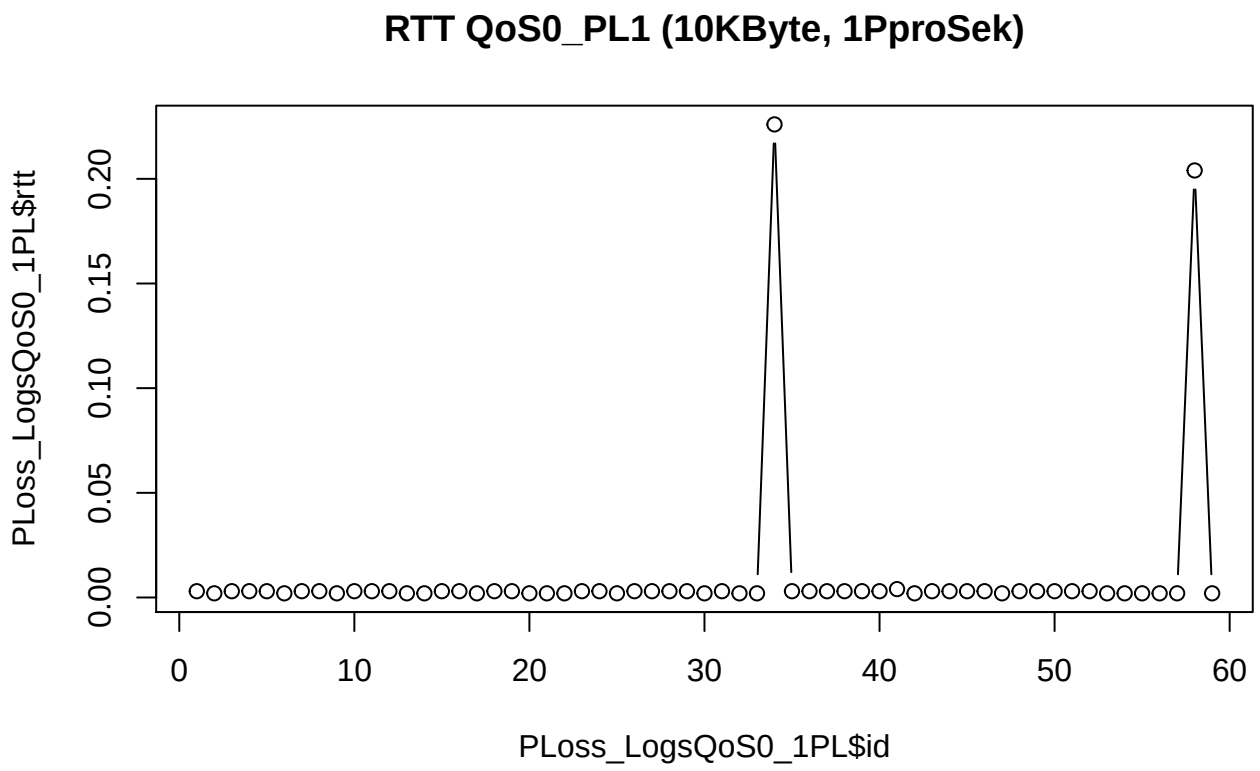

```
plot(PLoss_LogsQoS1$id, PLoss_LogsQoS1$rtt, type = "l", main = "RTT QoS1 (10KByte, 1PproSek)")
```



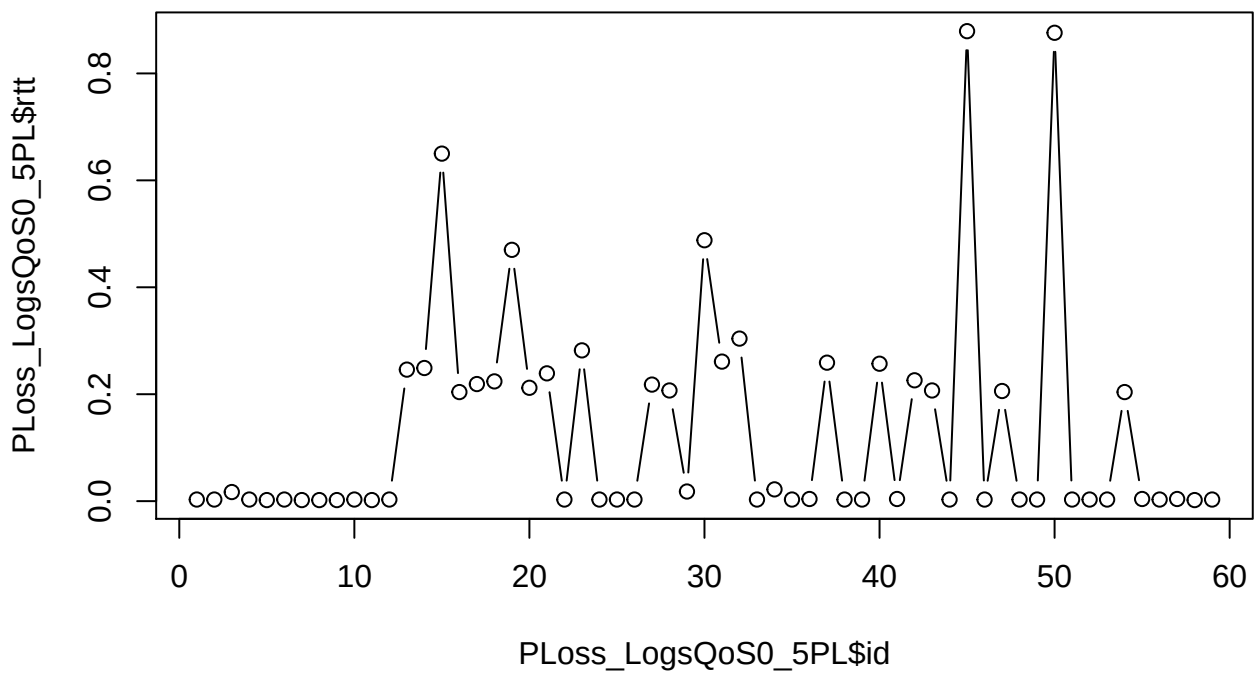

```
plot(PLoss_LogsQoS2$id, PLoss_LogsQoS2$rtt, type = "l", main = "RTT QoS2 (10KByte, 1PproSek)")
```



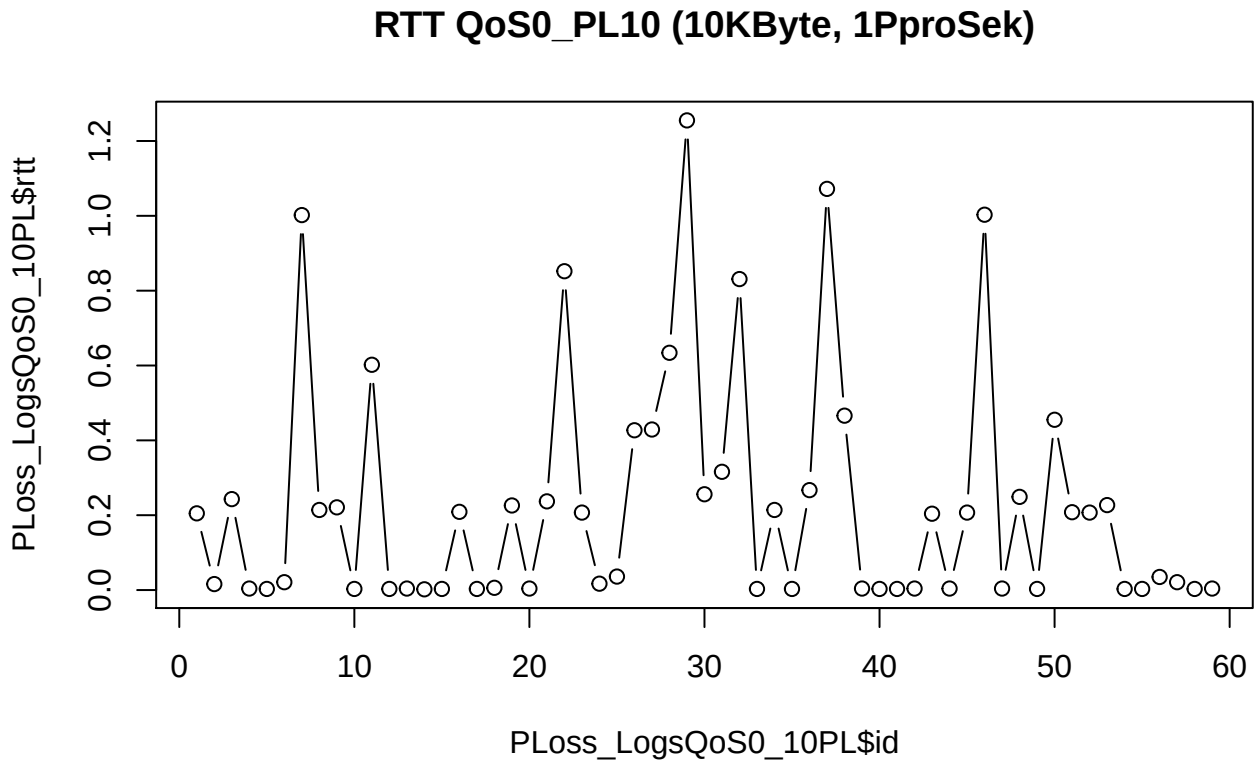

```
##################################
# Aufsplittung QoS nach PL_Proz #
##################################

PLoss_LogsQoS0_1PL<-PLoss_LogsQoS0[PLoss_LogsQoS0$PL_Proz == 1,]
PLoss_LogsQoS0_5PL<-PLoss_LogsQoS0[PLoss_LogsQoS0$PL_Proz == 5,]
PLoss_LogsQoS0_10PL<-PLoss_LogsQoS0[PLoss_LogsQoS0$PL_Proz == 10,]
PLoss_LogsQoS0_15PL<-PLoss_LogsQoS0[PLoss_LogsQoS0$PL_Proz == 15,]
PLoss_LogsQoS0_20PL<-PLoss_LogsQoS0[PLoss_LogsQoS0$PL_Proz == 20,]
PLoss_LogsQoS0_25PL<-PLoss_LogsQoS0[PLoss_LogsQoS0$PL_Proz == 25,]
PLoss_LogsQoS0_30PL<-PLoss_LogsQoS0[PLoss_LogsQoS0$PL_Proz == 30,]

plot(PLoss_LogsQoS0_1PL$id, PLoss_LogsQoS0_1PL$rtt, type = "b", main = "RTT QoS0_PL1 (10KByte, 1PproSek
```



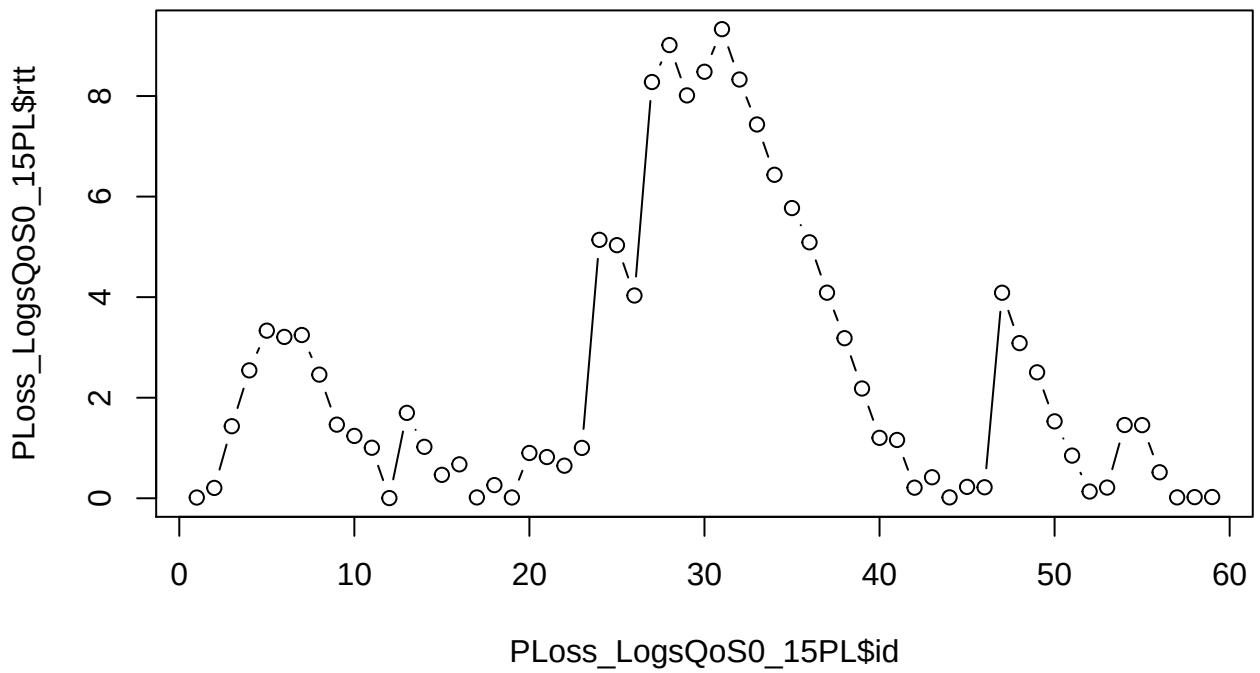

```
plot(PLoss_LogsQoS0_5PL$id, PLoss_LogsQoS0_5PL$rtt, type = "b", main = "RTT QoS0_PL5 (10KByte, 1PproSek
```



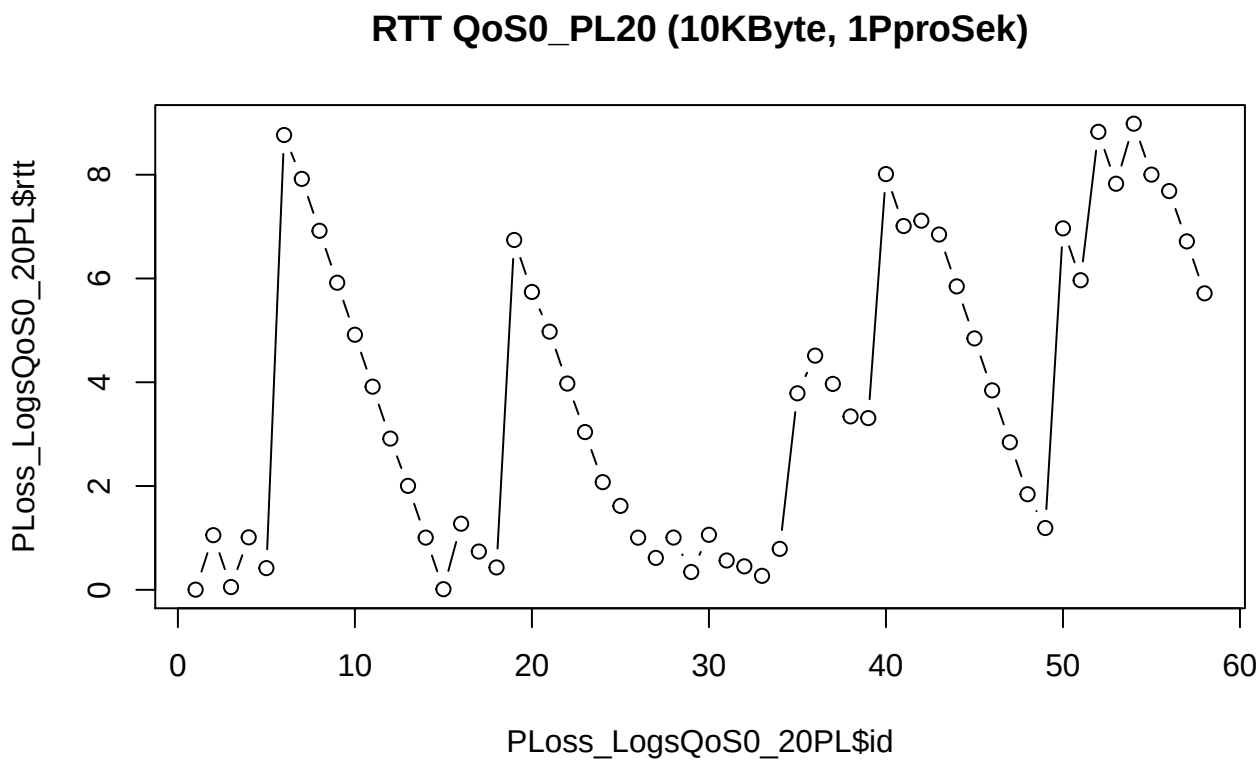

```
plot(PLoss_LogsQoS0_10PL$id, PLoss_LogsQoS0_10PL$rtt, type = "b", main = "RTT QoS0_PL10 (10KByte, 1Ppro
```



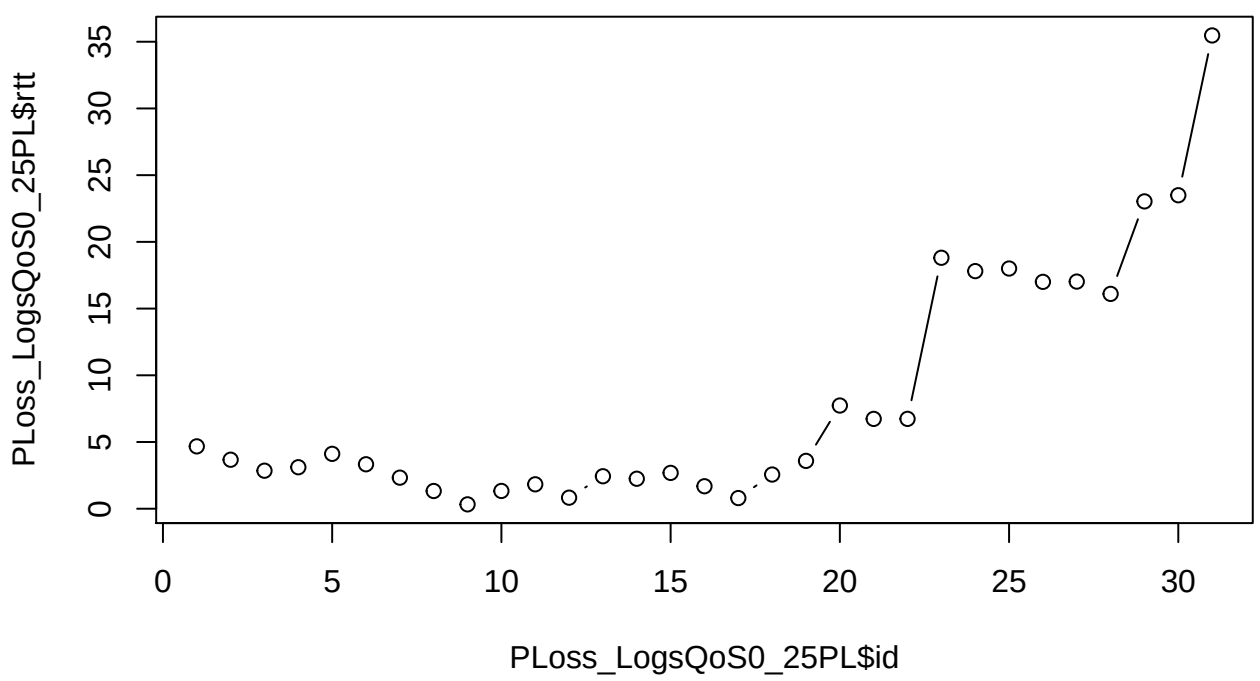

```
plot(PLoss_LogsQoS0_15PL$id, PLoss_LogsQoS0_15PL$rtt, type = "b", main = "RTT QoS0_PL15 (10KByte, 1Pproֆ
```



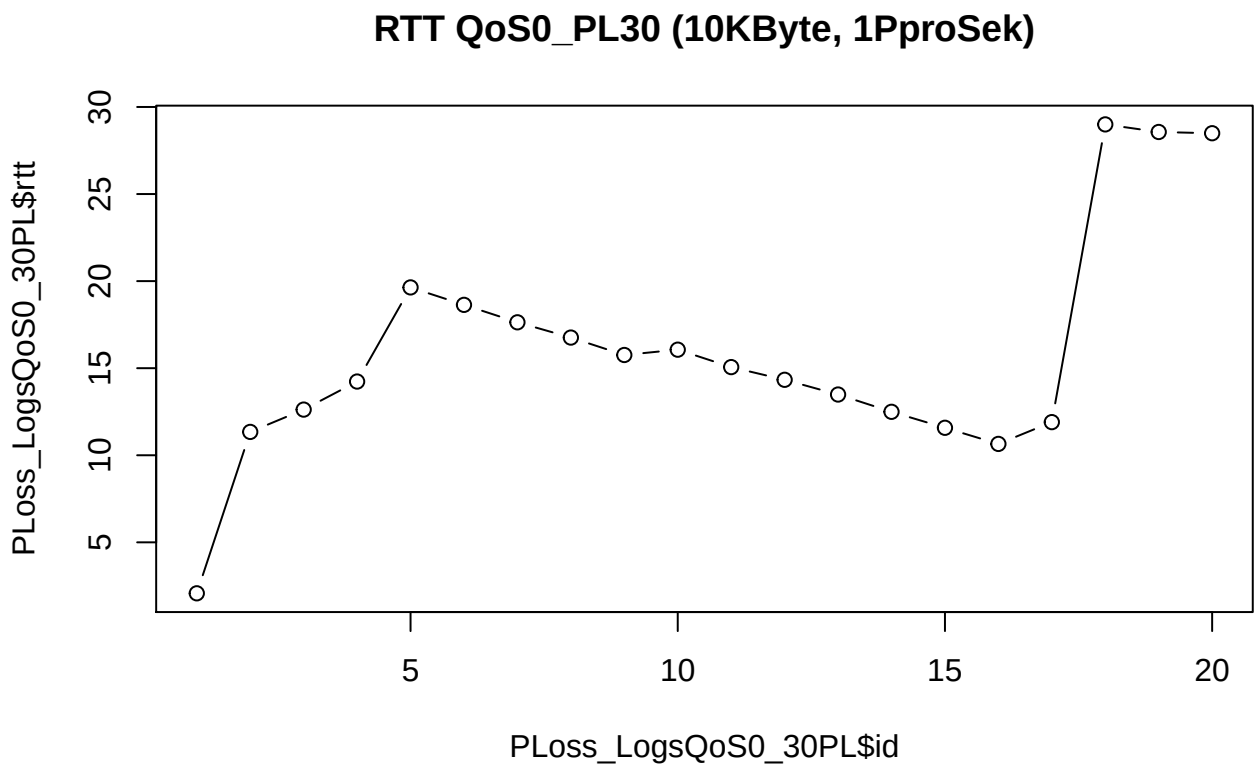

```
plot(PLoss_LogsQoS0_20PL$id, PLoss_LogsQoS0_20PL$rtt, type = "b", main = "RTT QoS0_PL20 (10KByte, 1Pproֆ
```



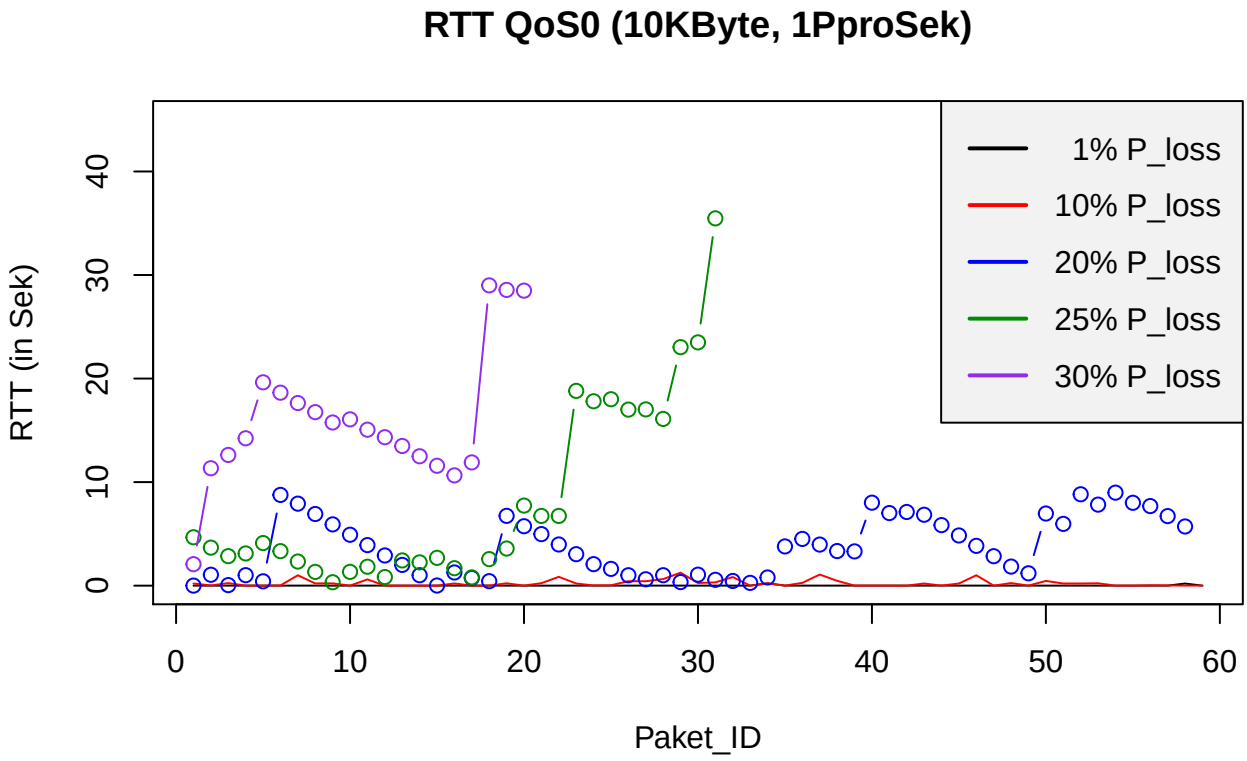

```
plot(PLoss_LogsQoS0_25PL$id, PLoss_LogsQoS0_25PL$rtt, type = "b", main = "RTT QoS0_PL25 (10KByte, 1Pproֆ
```



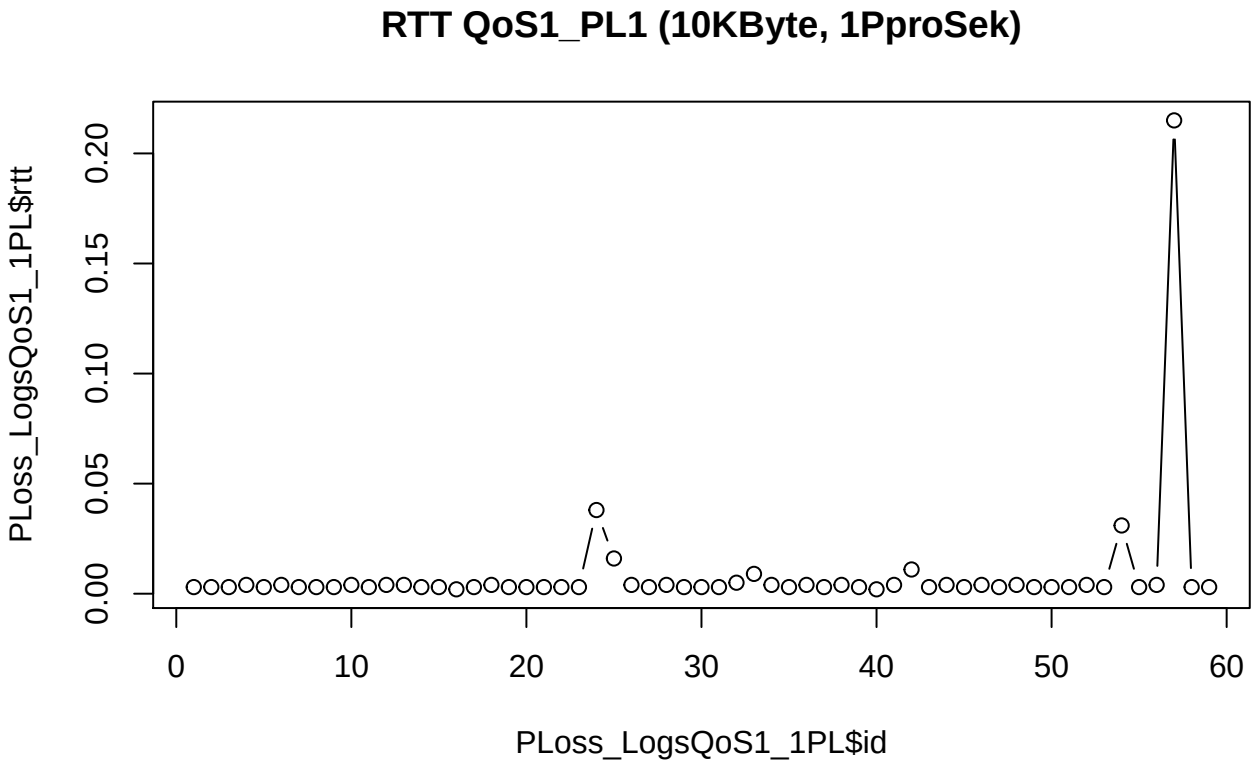

```
plot(PLoss_LogsQoS0_30PL$id, PLoss_LogsQoS0_30PL$rtt, type = "b", main = "RTT QoS0_PL30 (10KByte, 1Pproֆ
```



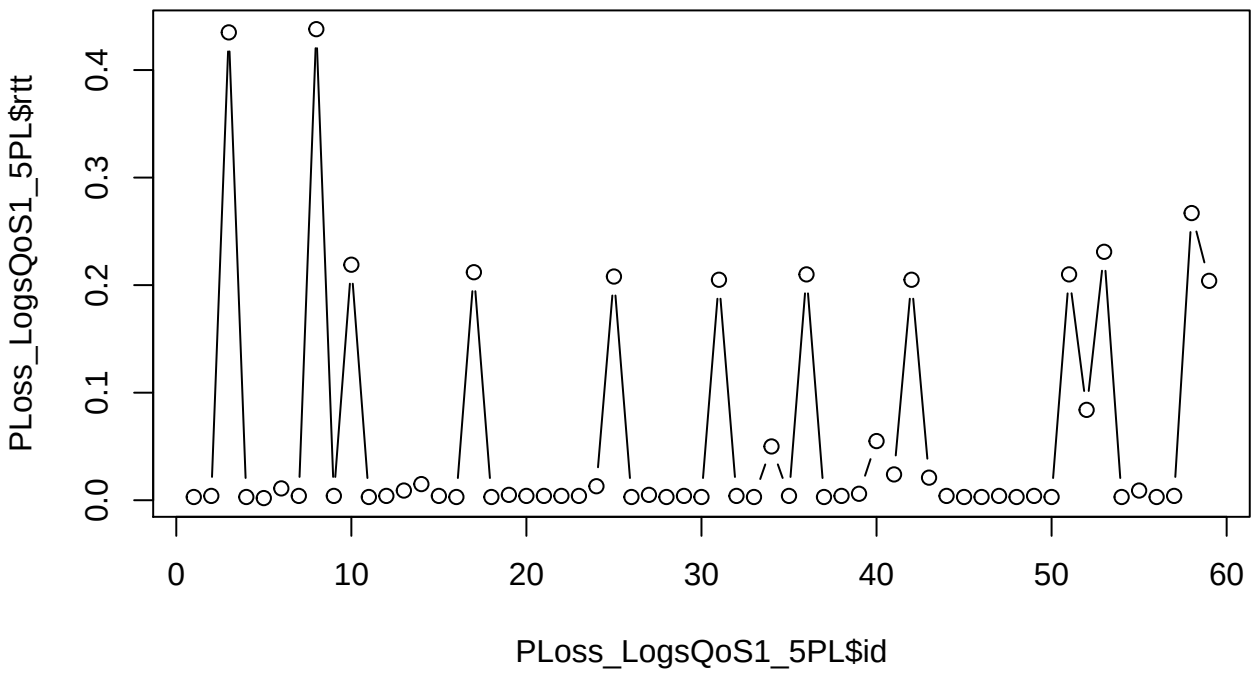

```
plot(PLoss_LogsQoS0_1PL$id, PLoss_LogsQoS0_1PL$rtt, main = "RTT QoS0 (10KByte, 1PproSek)", ylim = c(0, 4
     ylab = "RTT (in Sek)", xlab = "Paket_ID", type = "l")
points(PLoss_LogsQoS0_10PL$id, PLoss_LogsQoS0_10PL$rtt, col = "red", type = "l")
points(PLoss_LogsQoS0_20PL$id, PLoss_LogsQoS0_20PL$rtt, col = "blue", type = "b")
points(PLoss_LogsQoS0_25PL$id, PLoss_LogsQoS0_25PL$rtt, col = "green4", type = "b")
points(PLoss_LogsQoS0_30PL$id, PLoss_LogsQoS0_30PL$rtt, col = "purple2", type = "b")


legend("topright", c("  1% P_loss", "10% P_loss", "20% P_loss", "25% P_loss", "30% P_loss"), text.width
       text.col = "black", cex = 1   ,lwd = c(2, 2, 2),
       y.intersp = 1.5, merge = FALSE, bg = "gray95")
```



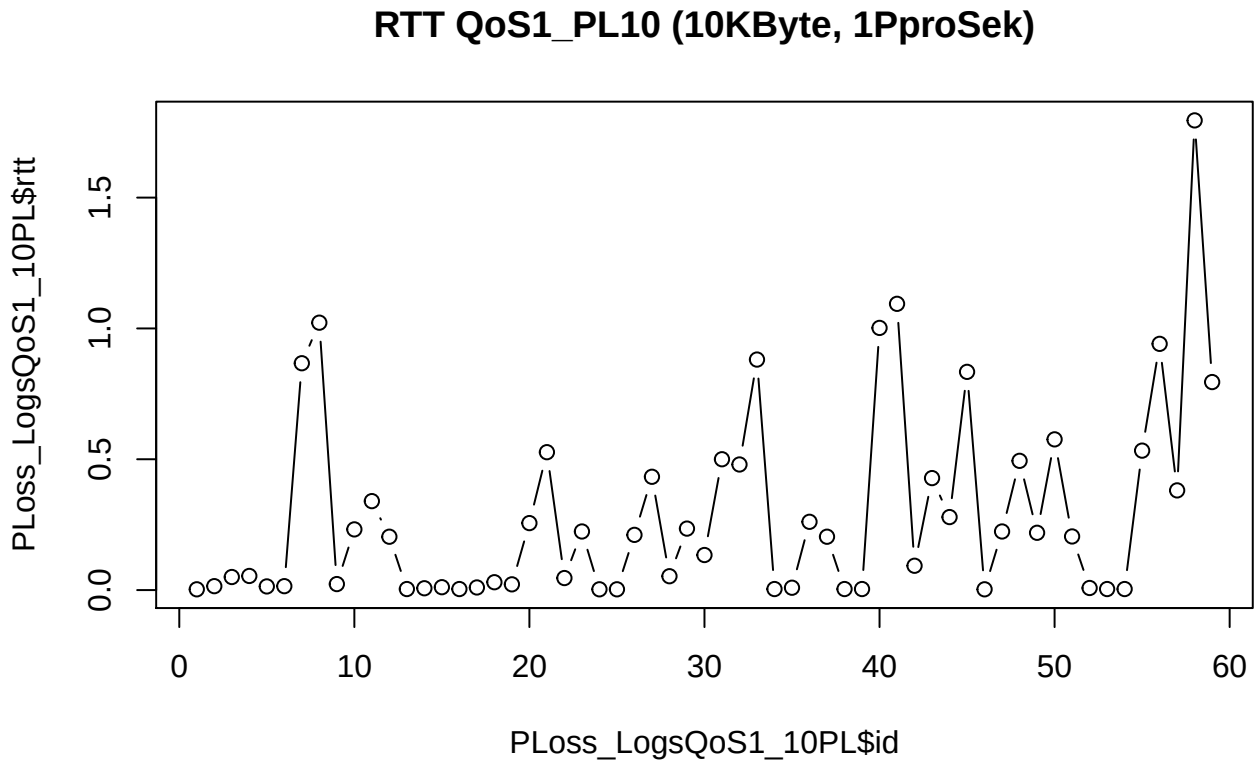

```
PLoss_LogsQoS1_1PL<-PLoss_LogsQoS1[PLoss_LogsQoS1$PL_Proz == 1,]
PLoss_LogsQoS1_5PL<-PLoss_LogsQoS1[PLoss_LogsQoS1$PL_Proz == 5,]
PLoss_LogsQoS1_10PL<-PLoss_LogsQoS1[PLoss_LogsQoS1$PL_Proz == 10,]
PLoss_LogsQoS1_15PL<-PLoss_LogsQoS1[PLoss_LogsQoS1$PL_Proz == 15,]
PLoss_LogsQoS1_20PL<-PLoss_LogsQoS1[PLoss_LogsQoS1$PL_Proz == 20,]
PLoss_LogsQoS1_25PL<-PLoss_LogsQoS1[PLoss_LogsQoS1$PL_Proz == 25,]
PLoss_LogsQoS1_30PL<-PLoss_LogsQoS1[PLoss_LogsQoS1$PL_Proz == 30,]

plot(PLoss_LogsQoS1_1PL$id, PLoss_LogsQoS1_1PL$rtt, type = "b", main = "RTT QoS1_PL1 (10KByte, 1PproSek
```



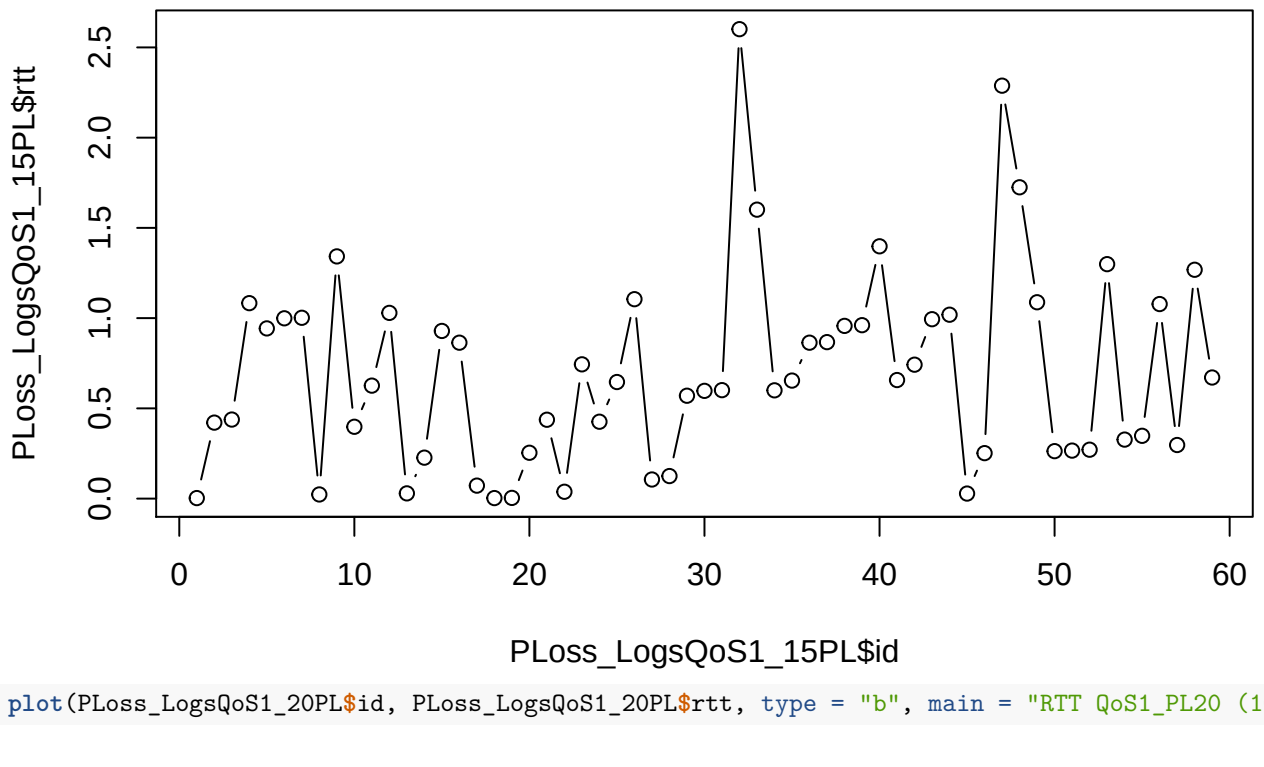

```
plot(PLoss_LogsQoS1_5PL$id, PLoss_LogsQoS1_5PL$rtt, type = "b", main = "RTT QoS1_PL5 (10KByte, 1PproSek
```



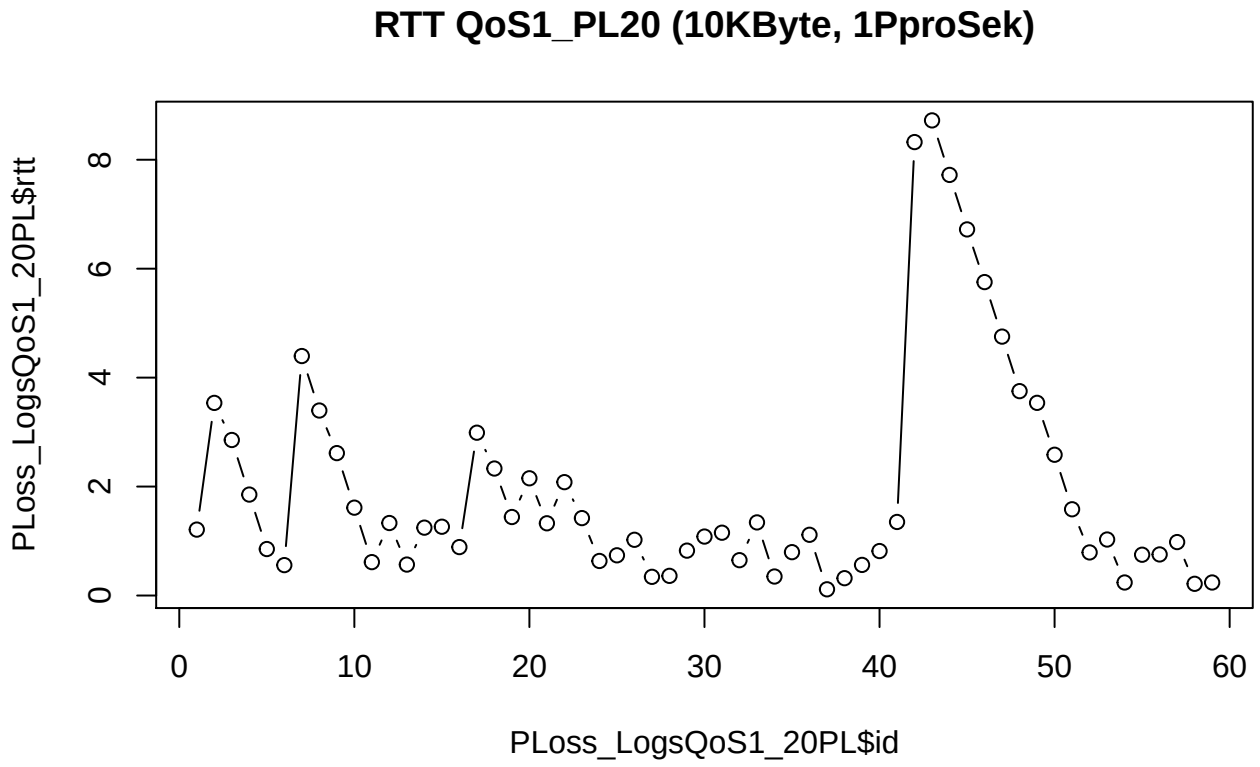

```
plot(PLoss_LogsQoS1_10PL$id, PLoss_LogsQoS1_10PL$rtt, type = "b", main = "RTT QoS1_PL10 (10KByte, 1Ppro
```



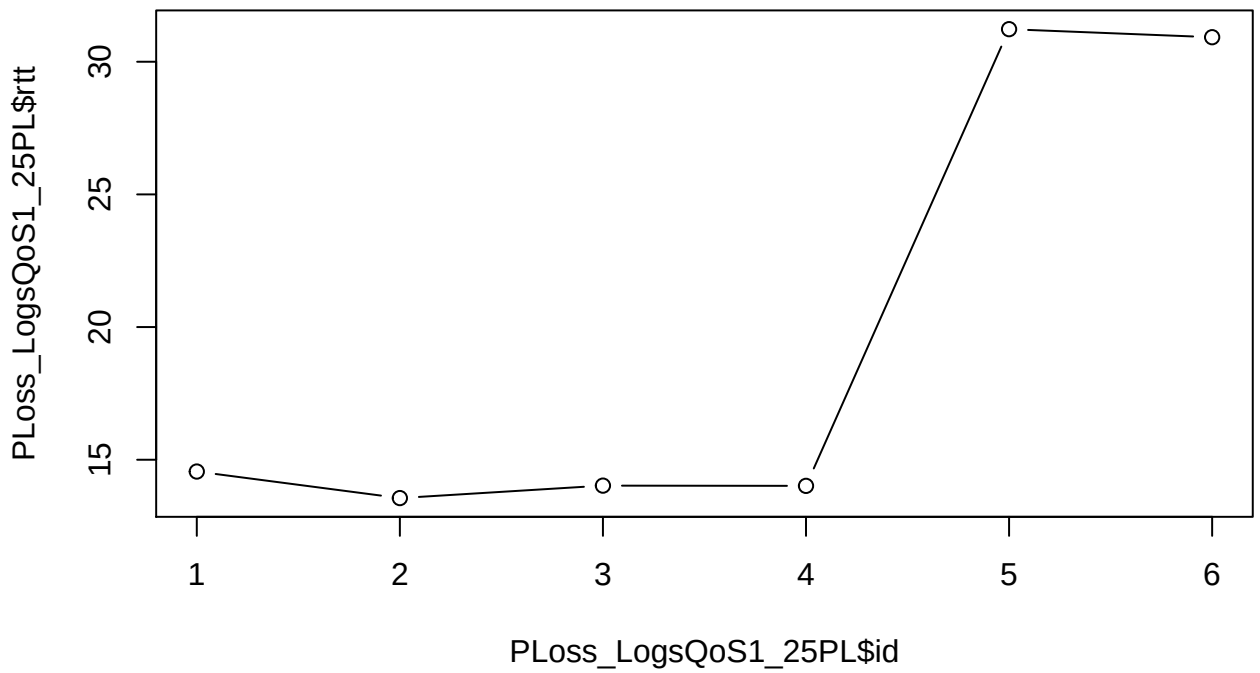

```
plot(PLoss_LogsQoS1_15PL$id, PLoss_LogsQoS1_15PL$rtt, type = "b", main = "RTT QoS1_PL15 (10KByte, 1Pproֆ
```



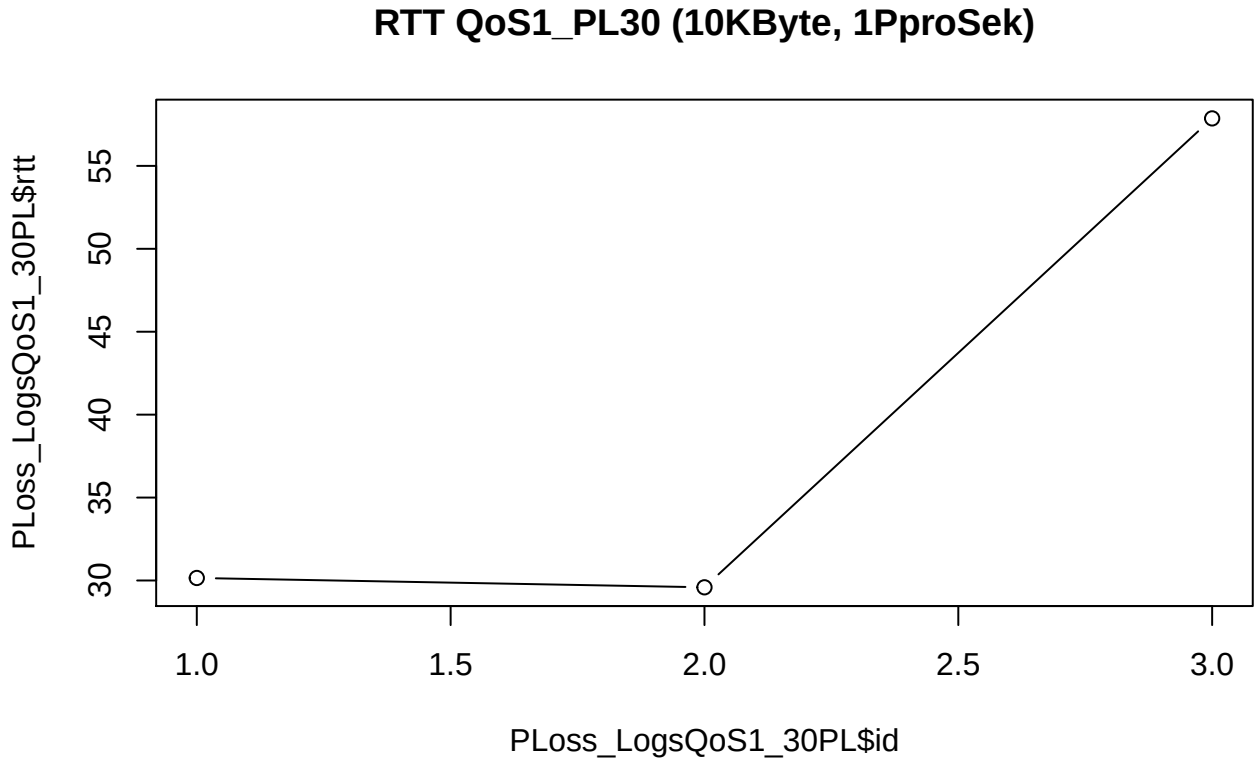

```
plot(PLoss_LogsQoS1_20PL$id, PLoss_LogsQoS1_20PL$rtt, type = "b", main = "RTT QoS1_PL20 (10KByte, 1Pproֆ
```



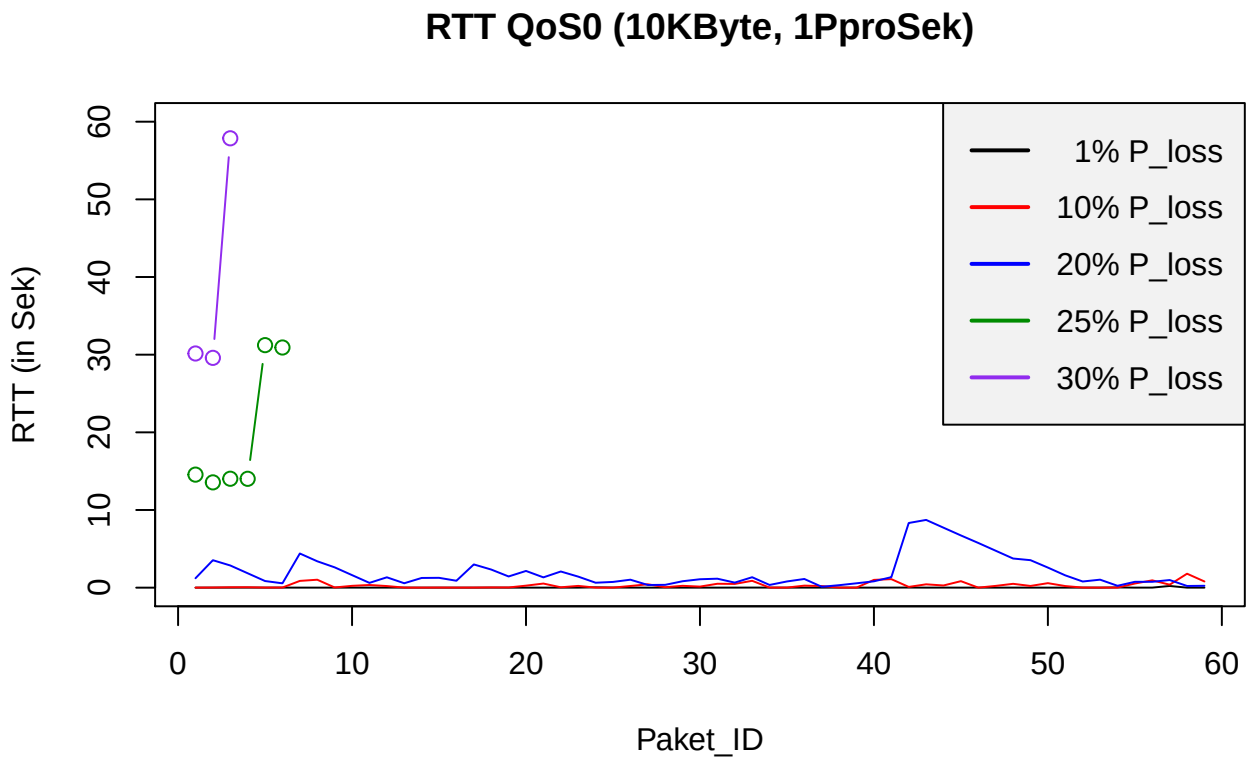

```
plot(PLoss_LogsQoS1_25PL$id, PLoss_LogsQoS1_25PL$rtt, type = "b", main = "RTT QoS1_PL25 (10KByte, 1ProS
```



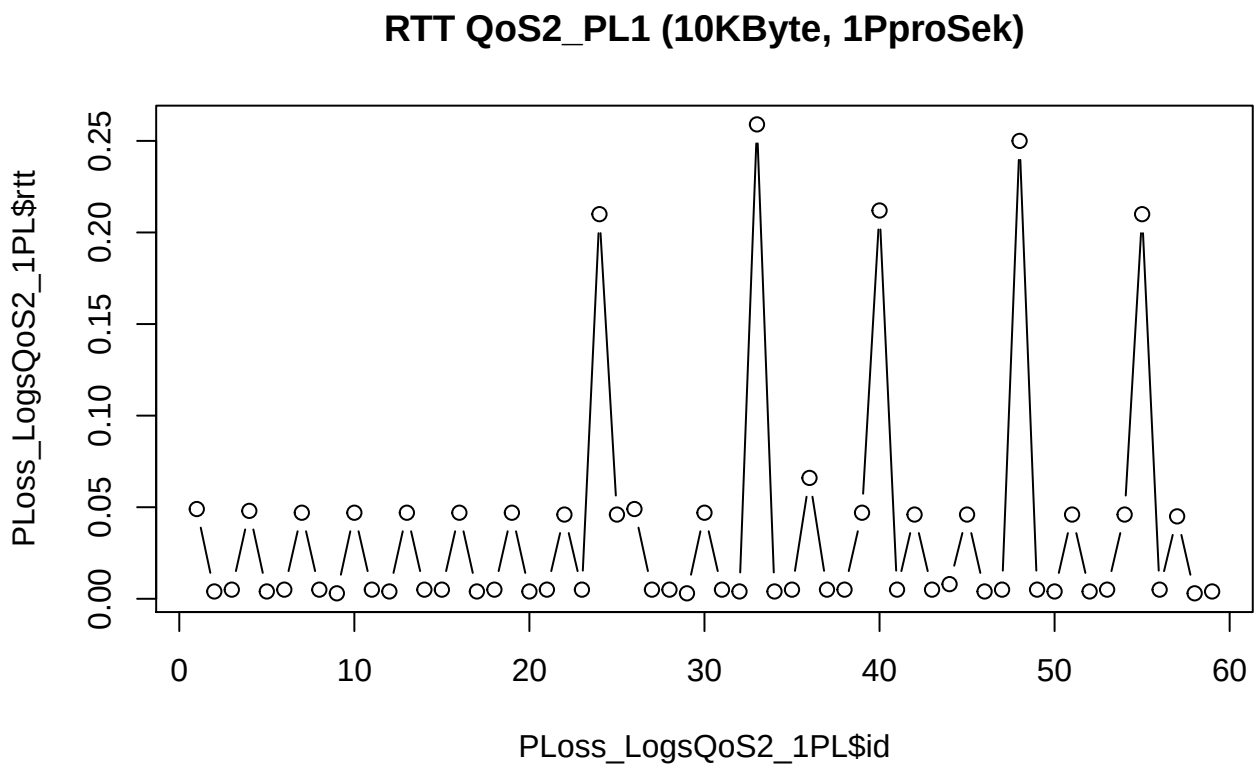

```
plot(PLoss_LogsQoS1_30PL$id, PLoss_LogsQoS1_30PL$rtt, type = "b", main = "RTT QoS1_PL30 (10KByte, 1ProS
```



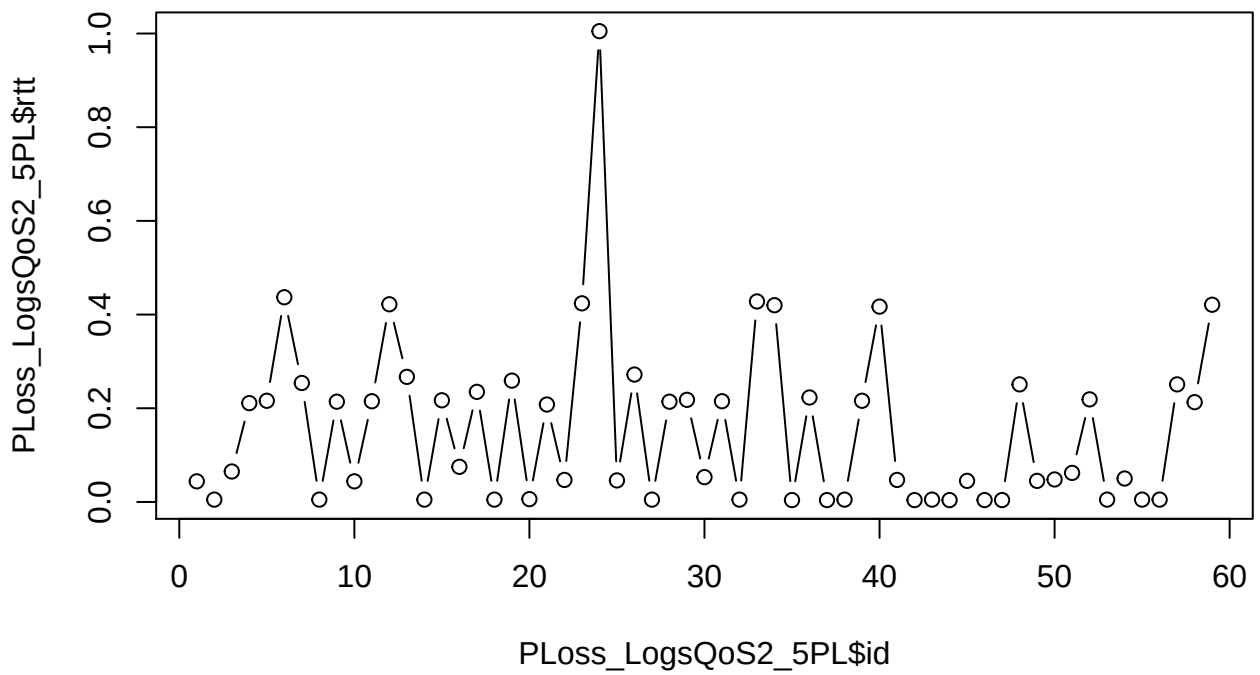

```
plot(PLoss_LogsQoS1_1PL$id, PLoss_LogsQoS1_1PL$rtt, main = "RTT QoS0 (10KByte, 1PproSek)", ylim = c(0, 
     ylab = "RTT (in Sek)", xlab = "Paket_ID", type = "l")
points(PLoss_LogsQoS1_10PL$id, PLoss_LogsQoS1_10PL$rtt, col = "red", type = "l")
points(PLoss_LogsQoS1_20PL$id, PLoss_LogsQoS1_20PL$rtt, col = "blue", type = "l")
points(PLoss_LogsQoS1_25PL$id, PLoss_LogsQoS1_25PL$rtt, col = "green4", type = "b")
points(PLoss_LogsQoS1_30PL$id, PLoss_LogsQoS1_30PL$rtt, col = "purple2", type = "b")


legend("topright", c("  1% P_loss", "10% P_loss", "20% P_loss", "25% P_loss", "30% P_loss"), text.width
       text.col = "black", cex = 1   ,lwd = c(2, 2, 2),
       y.intersp = 1.5, merge = FALSE, bg = "gray95")
```



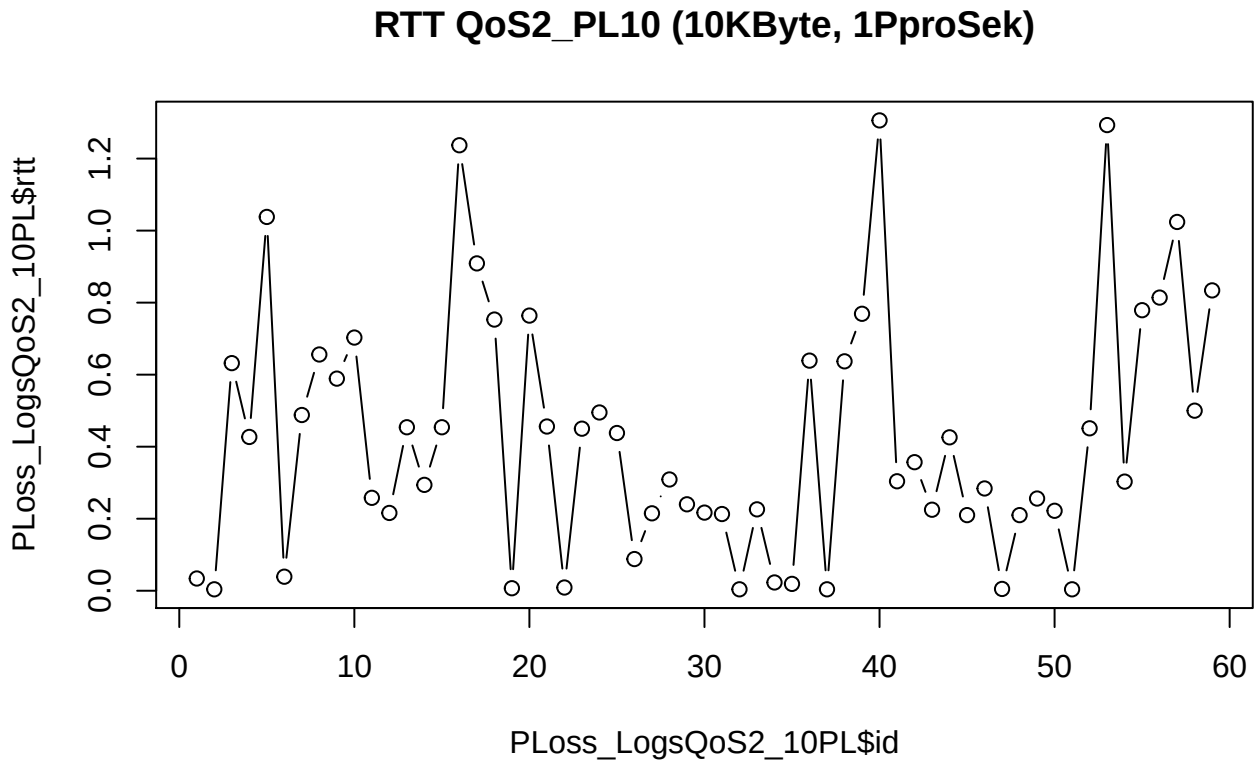

```
PLoss_LogsQoS2_1PL<-PLoss_LogsQoS2[PLoss_LogsQoS2$PL_Proz == 1,]
PLoss_LogsQoS2_5PL<-PLoss_LogsQoS2[PLoss_LogsQoS2$PL_Proz == 5,]
PLoss_LogsQoS2_10PL<-PLoss_LogsQoS2[PLoss_LogsQoS2$PL_Proz == 10,]
PLoss_LogsQoS2_15PL<-PLoss_LogsQoS2[PLoss_LogsQoS2$PL_Proz == 15,]
PLoss_LogsQoS2_20PL<-PLoss_LogsQoS2[PLoss_LogsQoS2$PL_Proz == 20,]
PLoss_LogsQoS2_25PL<-PLoss_LogsQoS2[PLoss_LogsQoS2$PL_Proz == 25,]
PLoss_LogsQoS2_30PL<-PLoss_LogsQoS2[PLoss_LogsQoS2$PL_Proz == 30,]

plot(PLoss_LogsQoS2_1PL$id, PLoss_LogsQoS2_1PL$rtt, type = "b", main = "RTT QoS2_PL1 (10KByte, 1PproSek
```



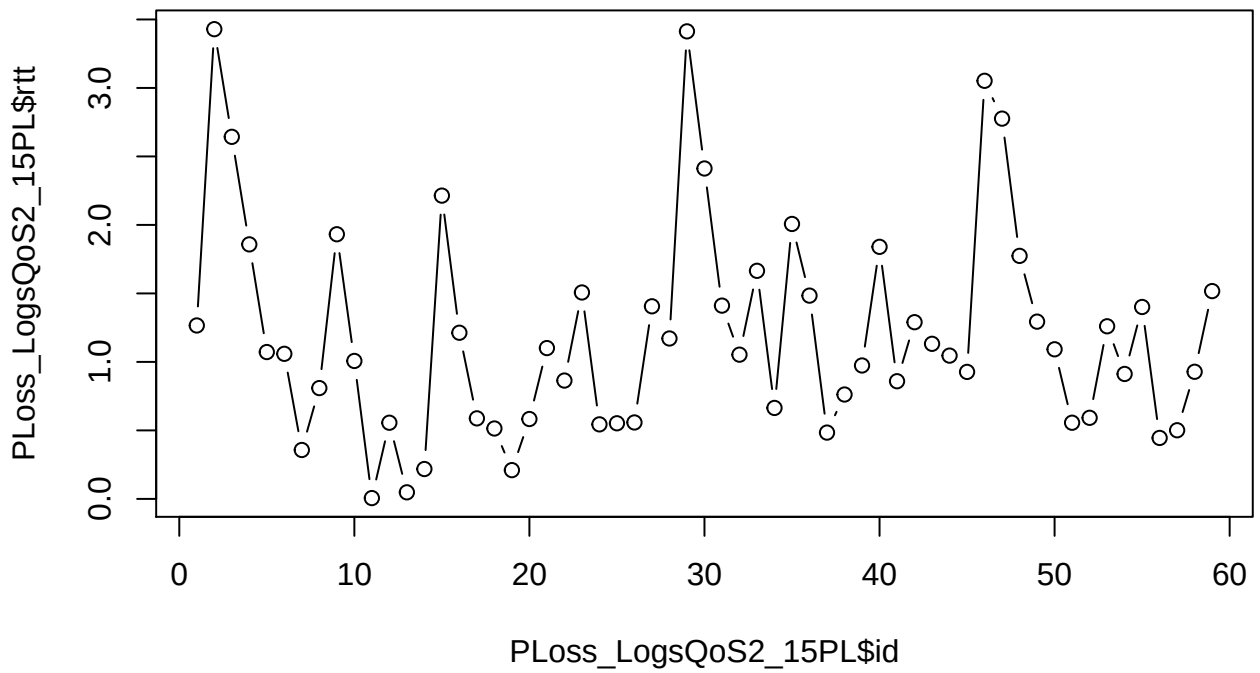

```
plot(PLoss_LogsQoS2_5PL$id, PLoss_LogsQoS2_5PL$rtt, type = "b", main = "RTT QoS2_PL5 (10KByte, 1PproSek
```



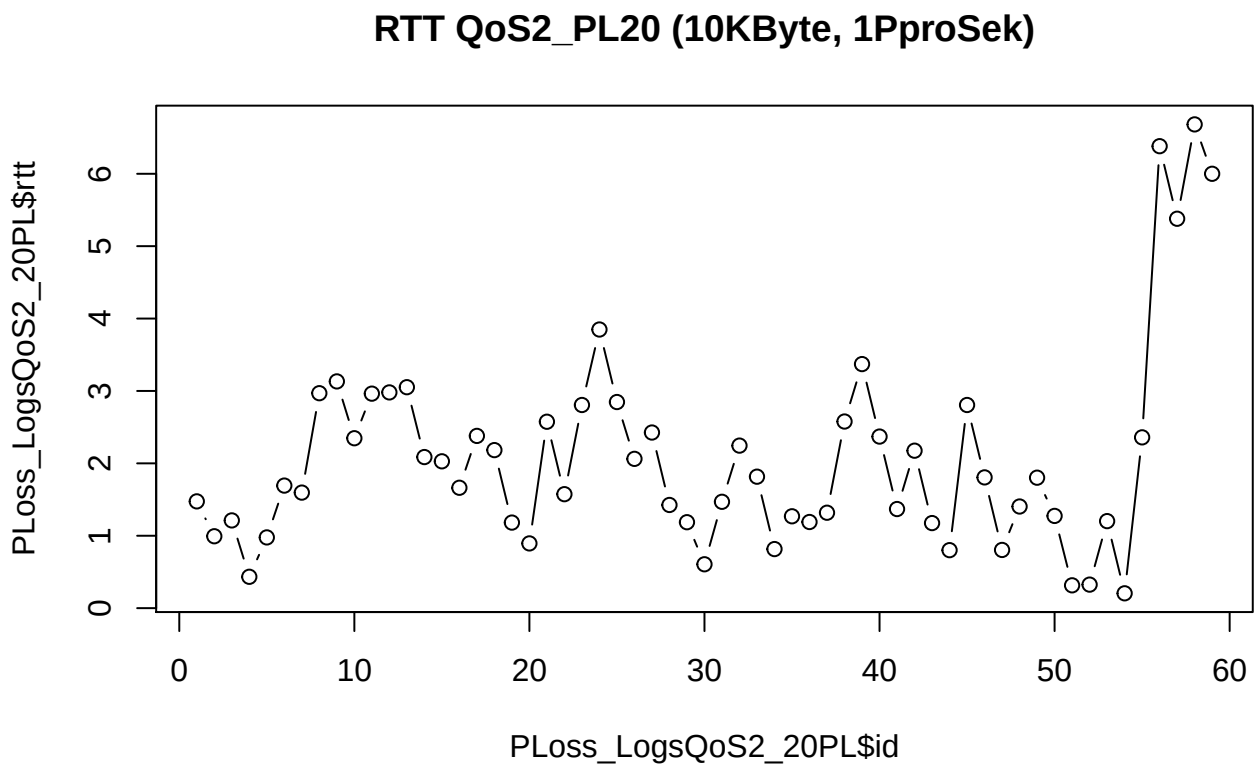

```
plot(PLoss_LogsQoS2_10PL$id, PLoss_LogsQoS2_10PL$rtt, type = "b", main = "RTT QoS2_PL10 (10KByte, 1Ppro
```



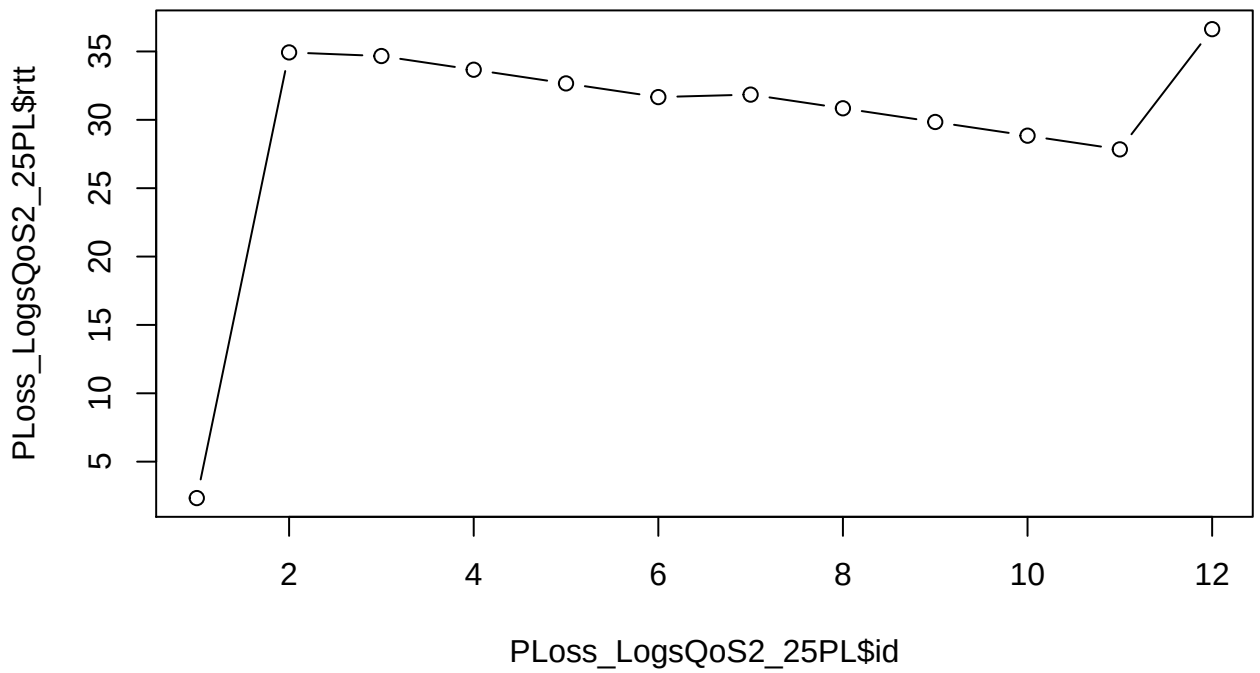

```
plot(PLoss_LogsQoS2_15PL$id, PLoss_LogsQoS2_15PL$rtt, type = "b", main = "RTT QoS2_PL15 (10KByte, 1Pproš
```



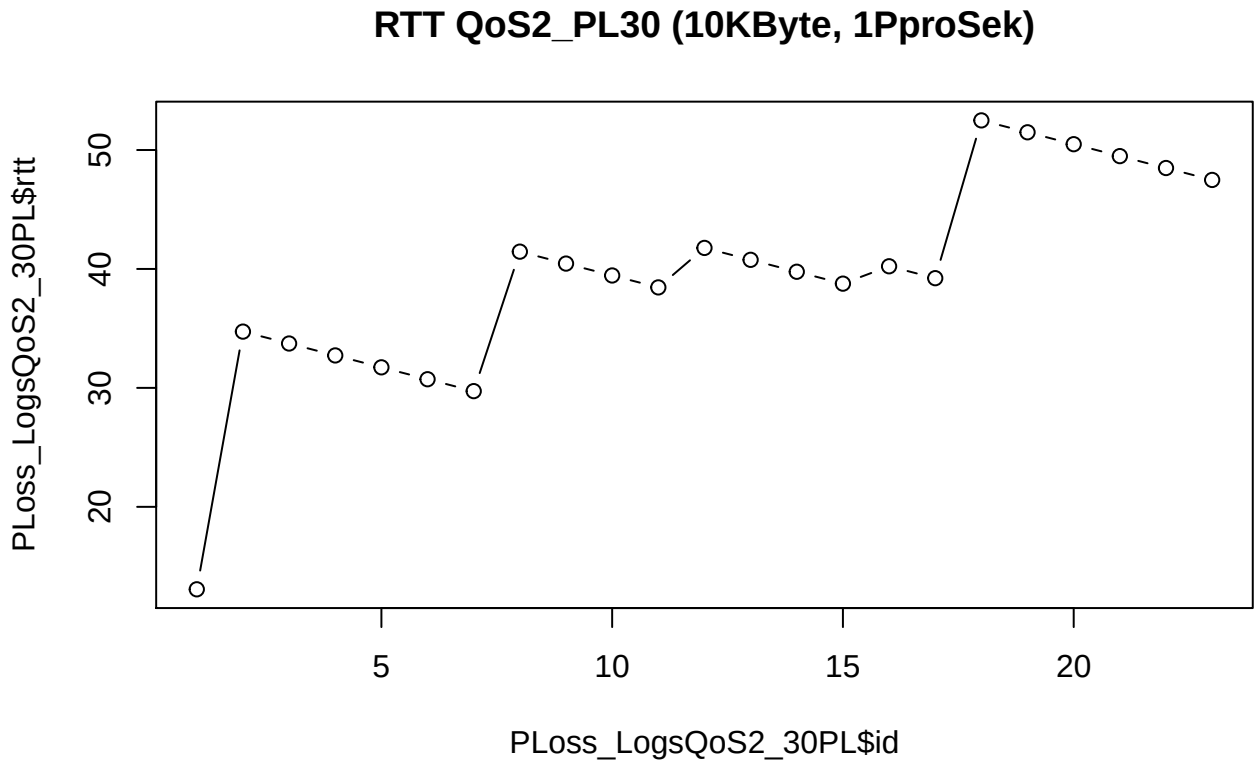

```
plot(PLoss_LogsQoS2_20PL$id, PLoss_LogsQoS2_20PL$rtt, type = "b", main = "RTT QoS2_PL20 (10KByte, 1Pproš
```



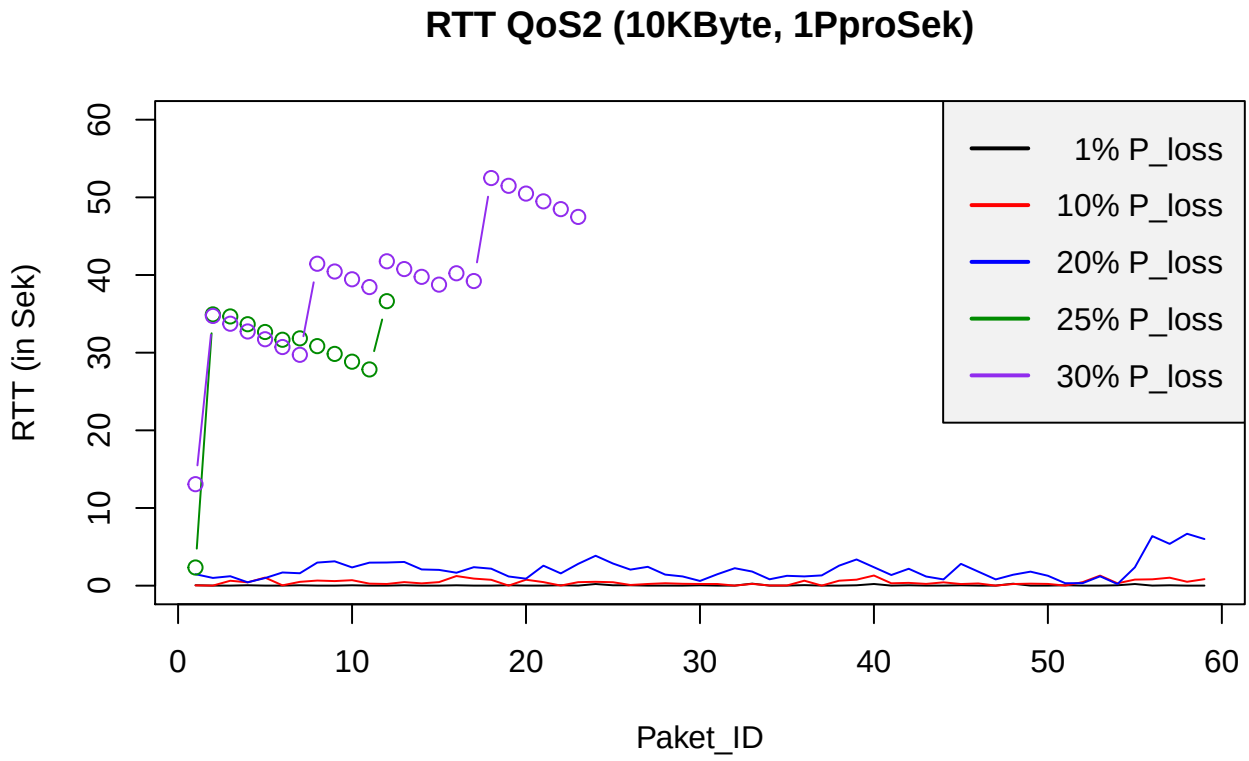

```
plot(PLoss_LogsQoS2_25PL$id, PLoss_LogsQoS2_25PL$rtt, type = "b", main = "RTT QoS2_PL25 (10KByte, 1Pproś
```




```
plot(PLoss_LogsQoS2_30PL$id, PLoss_LogsQoS2_30PL$rtt, type = "b", main = "RTT QoS2_PL30 (10KByte, 1Pproś
```




```
plot(PLoss_LogsQoS2_1PL$id, PLoss_LogsQoS2_1PL$rtt, main = "RTT QoS2 (10KByte, 1PproSek)", ylim = c(0, 
     ylab = "RTT (in Sek)", xlab = "Paket_ID", type = "l")
points(PLoss_LogsQoS2_10PL$id, PLoss_LogsQoS2_10PL$rtt, col = "red", type = "l")
points(PLoss_LogsQoS2_20PL$id, PLoss_LogsQoS2_20PL$rtt, col = "blue", type = "l")
points(PLoss_LogsQoS2_25PL$id, PLoss_LogsQoS2_25PL$rtt, col = "green4", type = "b")
points(PLoss_LogsQoS2_30PL$id, PLoss_LogsQoS2_30PL$rtt, col = "purple2", type = "b")


legend("topright", c("  1% P_loss", "10% P_loss", "20% P_loss", "25% P_loss", "30% P_loss"), text.width
       text.col = "black", cex = 1  ,lwd = c(2, 2, 2),
       y.intersp = 1.5, merge = FALSE, bg = "gray95")
```


RTT QoS2 (10KByte, 1PproSek)
RTT (in Sek)
0
10
20
30
40
50
60
Paket_ID
1% P_loss
10% P_loss
20% P_loss
25% P_loss
30% P_loss