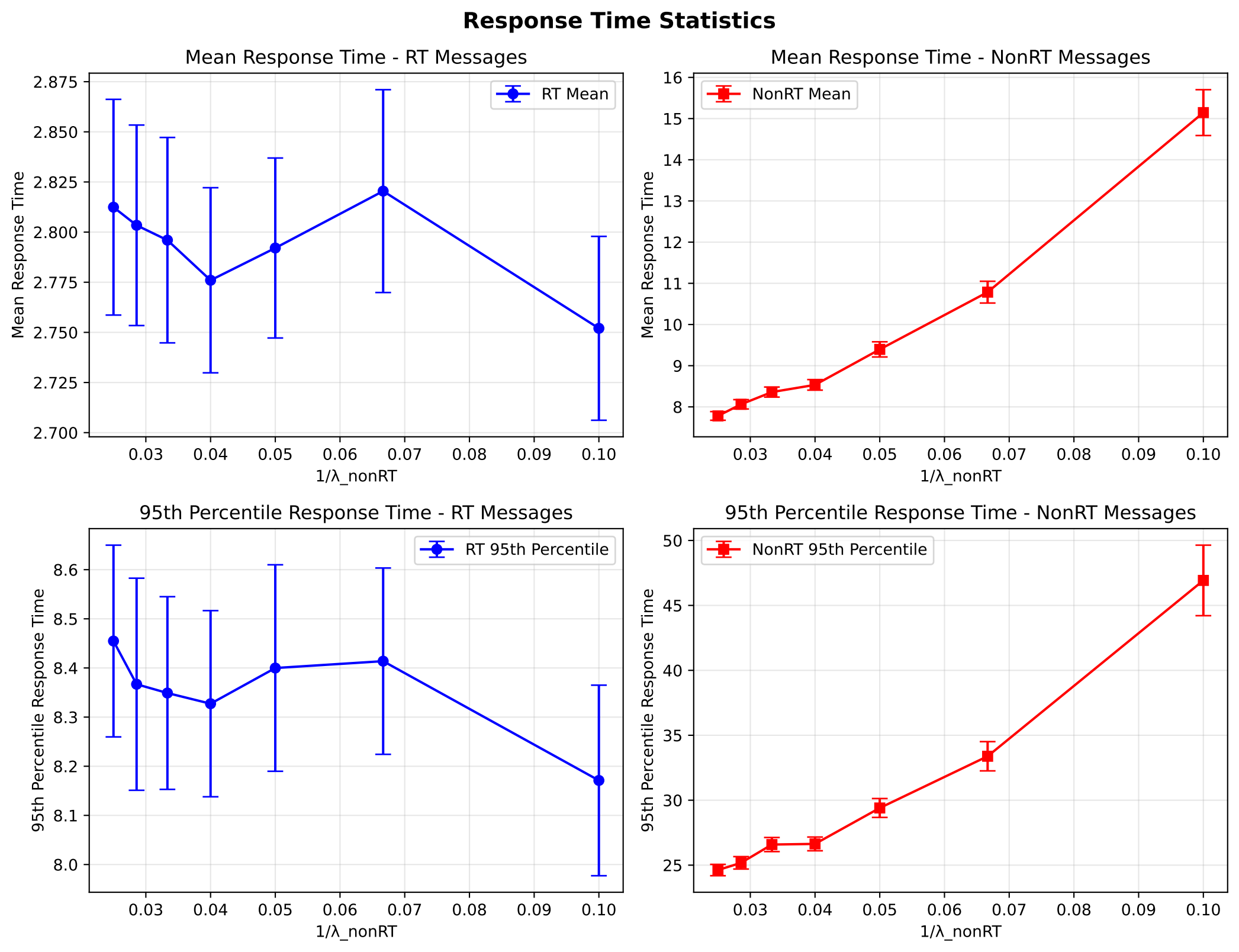
Task 3: Statistical Estimation of Response Time

Unity ID: arrao6

Parameters: MST_RT=2, MST_nonRT=4, MIAT_RT=7
Varying MIAT_nonRT from 10 to 40 in increments of 5

Batch Means Method: m=51 batches, b=1000 observations per batch

First batch ignored, using remaining 50 batches for statistics


Response Time Statistics
Mean Response Time - RT Messages
RT Mean
Mean Response Time
1/λ_nonRT
Mean Response Time - NonRT Messages
NonRT Mean
Mean Response Time
1/λ_nonRT
95th Percentile Response Time - RT Messages
RT 95th Percentile
95th Percentile Response Time
1/λ_nonRT
95th Percentile Response Time - NonRT Messages
NonRT 95th Percentile
95th Percentile Response Time
1/λ_nonRT

Results Summary Table

MIAT_nonRT	1/λ_nonRT	RT Mean	RT 95th %	NonRT Mean	NonRT 95th %
10.0	0.1000	2.7520	8.1711	15.1451	46.9242
15.0	0.0667	2.8204	8.4138	10.7856	33.3846
20.0	0.0500	2.7921	8.3999	9.3959	29.4019
25.0	0.0400	2.7760	8.3273	8.5343	26.6359
30.0	0.0333	2.7960	8.3490	8.3594	26.5862
35.0	0.0286	2.8034	8.3669	8.0622	25.1783
40.0	0.0250	2.8124	8.4548	7.7802	24.6222

Confidence Intervals (95%)

MIAT_nonRT = 10.0:

RT Mean CI: [2.7062, 2.7979]

RT 95th % CI: [7.9772, 8.3650]

NonRT Mean CI: [14.5886, 15.7015]

NonRT 95th % CI: [44.2089, 49.6395]

MIAT_nonRT = 15.0:

RT Mean CI: [2.7699, 2.8710]

RT 95th % CI: [8.2242, 8.6034]

NonRT Mean CI: [10.5212, 11.0500]

NonRT 95th % CI: [32.2595, 34.5097]

MIAT_nonRT = 20.0:

RT Mean CI: [2.7472, 2.8369]

RT 95th % CI: [8.1898, 8.6100]

NonRT Mean CI: [9.2116, 9.5801]

NonRT 95th % CI: [28.6746, 30.1292]

MIAT_nonRT = 25.0:

RT Mean CI: [2.7298, 2.8221]

RT 95th % CI: [8.1379, 8.5166]

NonRT Mean CI: [8.4061, 8.6624]

NonRT 95th % CI: [26.1077, 27.1640]

MIAT_nonRT = 30.0:

RT Mean CI: [2.7448, 2.8472]

RT 95th % CI: [8.1529, 8.5450]

NonRT Mean CI: [8.2373, 8.4815]

NonRT 95th % CI: [26.0436, 27.1289]

MIAT_nonRT = 35.0:

RT Mean CI: [2.7534, 2.8534]

RT 95th % CI: [8.1511, 8.5826]

NonRT Mean CI: [7.9485, 8.1758]

NonRT 95th % CI: [24.6999, 25.6567]

MIAT_nonRT = 40.0:

RT Mean CI: [2.7586, 2.8662]

RT 95th % CI: [8.2597, 8.6499]

NonRT Mean CI: [7.6749, 7.8855]

NonRT 95th % CI: [24.1855, 25.0589]

Analysis and Comments

Task 3.1 Results Analysis:

As 1/λ_nonRT increases (i.e., MIAT_nonRT increases), the nonRT arrival rate decreases.
This means fewer nonRT messages compete for server resources, leading to:
1. Lower mean response time for nonRT messages (less queueing)
2. Lower 95th percentile for nonRT messages
3. Potentially lower response times for RT messages as well, since there's less
   preemption and interference from nonRT messages

The confidence intervals show the uncertainty in our estimates. Wider intervals
indicate higher variance in the response times, which could be due to:
- High variability in inter-arrival times (exponential distribution)
- High variability in service times
- System approaching saturation

Task 3.2 Results Analysis:

With fixed MST_RT=2, MST_nonRT=4, and MIAT_RT=7, and varying MIAT_nonRT:

RT Messages: RT messages have priority and can preempt nonRT messages.
Their response time is primarily affected by:
- Their own arrival rate (fixed at MIAT_RT=7)
- Service time (fixed at MST_RT=2)
- Interference from nonRT messages (decreases as MIAT_nonRT increases)

NonRT Messages: NonRT messages experience:
- Direct impact from their own arrival rate (MIAT_nonRT)
- Preemption by RT messages
- As MIAT_nonRT increases, fewer nonRT messages arrive, reducing both
  queue length and preemption frequency

Expected Trends:
1. NonRT mean and 95th percentile should decrease as 1/λ_nonRT increases
2. RT response times may show slight improvement as nonRT interference decreases
3. Confidence intervals should be relatively stable if batch size is adequate