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# Real-time CORBA Trade Study

# Volume 4 – Basic IDL Scenario 4

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|---|---|---|---|
| AUTHOR: | H. Rebecca Callison and Daniel G. Butler | 9-5430 | |
| | Sign and type:  First Name MI Last Name | Org. Number | Date |
| APPROVAL: | Marilynn B. Goo | 9-5430 | |
| | Sign and type:  First Name MI Last Name | Org. Number | Date |
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# 1. Introduction

This volume presents the description and detailed results for testing under Basic IDL Scenario 4: Client and Server on Different SPARCs, 70 ms Frame Time. The structure of the Basic IDL test is described in Volume 1, Section 3.4.4 of this report. Some results from Scenario 2 (Client and Server on Different SPARCs, No Delay) are also included for comparison.

# 2. Call & Return Operations

For the Call & Return Operations, we report the results for four data series: (1) floats as representative of primitive data transfers, (2) aligned records, (3) non-aligned records, and (4) Any transfers.

## 2.1 Summary: Primitives, Records, Any

Figure 1 summarizes the comparative performance of the three ORBs when the Basic IDL test is executed with client and background processes running on one SPARC computer, the server on a second. The two SPARC hosts are connected via a 10Mbps Ethernet. The Any series for HARDPack is an order of magnitude greater than other data values and has been omitted from this graph and most subsequent discussion.

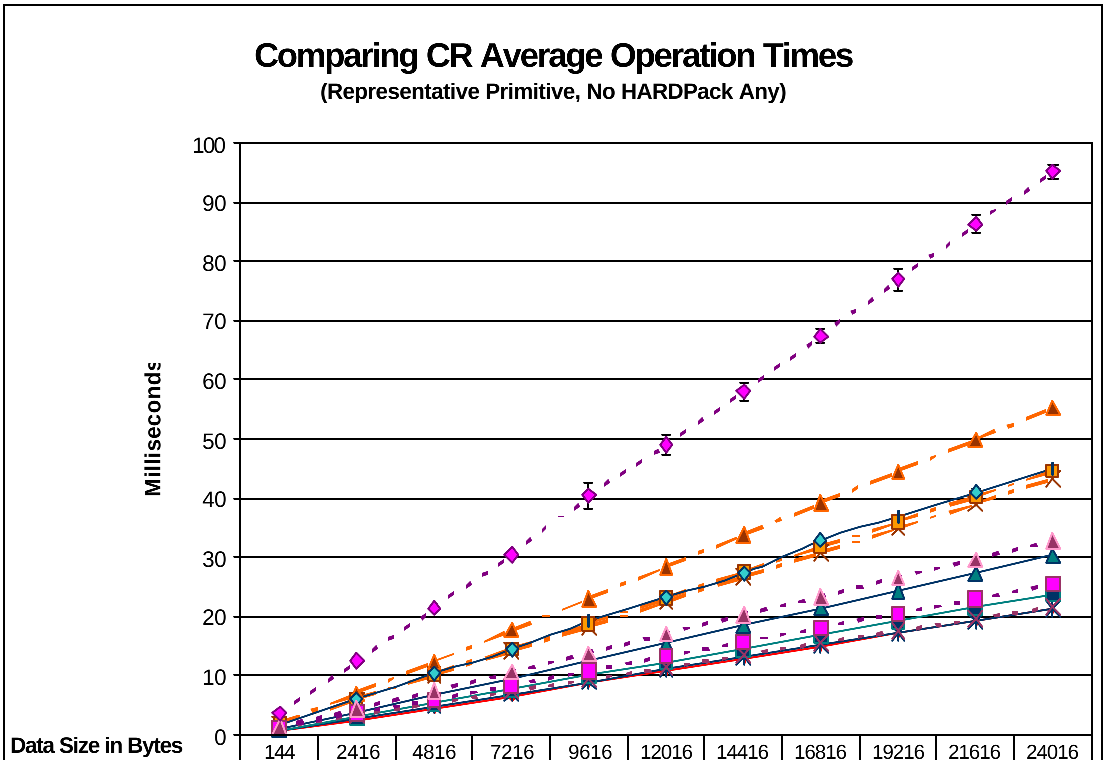
As in Basic IDL Scenario 1A, discussed in Volume 2 of this report, each of the lines in the graph captures the *average* operation time for messages of increasing size involving a particular data type. Socket data plus representative ORB operation times are again presented. Since all of the ORBs under evaluation use sockets to transfer data internally within the ORB, the socket performance represents a practical lower bound on the performance that can be achieved, helping us isolate the overhead added by the ORB. In this scenario, the socket measurements also help identify the underlying cost of transferring requests over a network. As with the single machine scenario, the socket performance we measured should not be construed as the best performance that can be achieved on basic sockets. We tuned our socket program just enough to get rid of obvious knees, peaks, and valleys for the program under test but did not explore the limits of socket performance.

Unless otherwise noted, the error bars in the graphs of this section depict the range of one standard deviation around the mean observed operation time. We use these bars to visually signal the temporal predictability of operations in the series. In Call & Return operations of this scenario, however, larger standard deviations often arose from the cost of a single operation in the series, usually the first. In these cases, the standard deviation bars exaggerate the amount of jitter that the ORB user can expect to observe over a routine series of operations.

The data in Figure 1 provides a few fairly obvious insights:

1. The CORBA Any transfer method is expensive and should be used with caution.
2. ORB*express* outperforms other ORBS on Any transfers by a significant margin. (We found this advantage to hold across all test scenarios.)
3. For other transfer methods, the ORB behaviors are closely grouped, too closely for any insights to be drawn from this particular graph.

**Scenario 4: Client, Server on Different Solaris Hosts**




| Data Size in Bytes | 144 | 2416 | 4816 | 7216 | 9616 | 12016 | 14416 | 16816 | 19216 | 21616 | 24016 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Socket | 0.55186 | 2.47129 | 4.49214 | 6.49612 | 8.76745 | 10.811 | 12.8076 | 14.8618 | 17.1343 | 19.1168 | 21.1661 |
| HARDPack Float | 1.82918 | 5.86606 | 9.91672 | 14.0925 | 18.1861 | 22.3787 | 26.6574 | 30.692 | 34.9033 | 38.9976 | 43.194 |
| HARDPack Record | 1.82719 | 5.9951 | 10.2087 | 14.4769 | 18.7045 | 23.0252 | 27.4498 | 31.6438 | 35.9832 | 40.2331 | 44.5363 |
| HARDP NA Record | 1.88742 | 6.94917 | 12.2889 | 17.6438 | 22.9879 | 28.3641 | 33.7439 | 39.0993 | 44.4556 | 49.8088 | 55.1616 |
| ORBexpress Float | 0.80377 | 2.7818 | 4.83457 | 6.88313 | 8.87832 | 10.9449 | 13.0192 | 15.0331 | 17.1091 | 19.1057 | 21.2346 |
| ORBex Record | 0.81414 | 3.0244 | 5.33684 | 7.63177 | 9.90937 | 12.2055 | 14.5128 | 16.8025 | 19.1224 | 21.392 | 23.7307 |
| ORBex NA Record | 0.84416 | 3.68807 | 6.60806 | 9.58384 | 12.5116 | 15.4598 | 18.4299 | 21.3694 | 24.3317 | 27.2819 | 30.2798 |
| ORBexpress Any | 1.62926 | 5.92985 | 10.3428 | 14.3066 | 19.1218 | 23.1513 | 27.1603 | 32.8139 | 36.8431 | 40.9914 | 44.9264 |
| TAO Float | 1.2556 | 3.29115 | 5.22876 | 7.28047 | 9.27898 | 11.3399 | 13.4171 | 15.4633 | 17.5274 | 19.5322 | 21.6006 |
| TAO Record | 1.2736 | 3.62006 | 5.90482 | 8.31184 | 10.7522 | 13.208 | 15.627 | 18.104 | 20.4338 | 22.857 | 25.4183 |
| TAO NA Record | 1.31031 | 4.31163 | 7.38014 | 10.5463 | 13.7382 | 17.0256 | 20.2691 | 23.3544 | 26.5309 | 29.5764 | 32.7332 |
| TAO Any | 3.60706 | 12.4265 | 21.3337 | 30.3131 | 40.3146 | 48.9994 | 57.9356 | 67.277 | 76.7953 | 86.2094 | 95.0703 |

Figure 1. Call & Return Operations in Networked SPARCs: Average

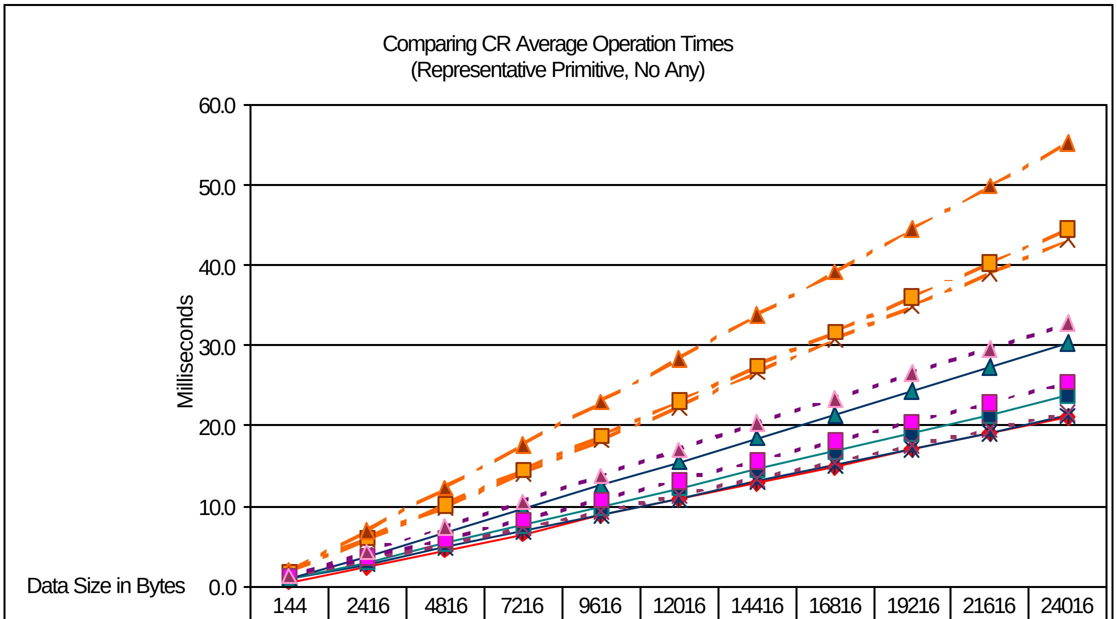
## 2.2 Records and Primitives

In Figure 2 we remove CORBA_Any transfers from the graph, enabling a closer look at other transfer methods and data types. With the 10 Mbps Ethernet inserted into the path between client and server, some of the distinctions between ORBs present in Scenario 1a change. As shown, ORB*express* and TAO results for primitive data transfers now lie very close to the graph of socket transfer times.

Comparing the trend line equations for transfer of the "float" primitive data, equations which appear in Table 1, we find that the incremental cost of a byte of data transferred by TAO is about the same as that of a byte transferred by ORB*express*. These linear trend line calculations are very basic, but they show that the incremental performance of these two ORBs on simple data is very similar.

- Note that in addition to demonstrating similar incremental performance, TAO has also cut the disadvantage in basic overhead that ORB*express* held in the scenario run in a single SPARC. The 600 microsecond advantage held by ORB*express* in Scenario 1a reduces to about 450 microseconds in this networked environment.

**Scenario 4: Client, Server on Different Solaris Hosts**




| Data Size in Bytes | 144 | 2416 | 4816 | 7216 | 9616 | 12016 | 14416 | 16816 | 19216 | 21616 | 24016 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Socket | 0.55186 | 2.47129 | 4.49214 | 6.49612 | 8.76745 | 10.811 | 12.8076 | 14.8618 | 17.1343 | 19.1168 | 21.1661 |
| HARDPack Float | 1.82918 | 5.86606 | 9.91672 | 14.0925 | 18.1861 | 22.3787 | 26.6574 | 30.692 | 34.9033 | 38.9976 | 43.194 |
| HARDPack Record | 1.82719 | 5.9951 | 10.2087 | 14.4769 | 18.7045 | 23.0252 | 27.4498 | 31.6438 | 35.9832 | 40.2331 | 44.5363 |
| HARDP NA Record | 1.88742 | 6.94917 | 12.2889 | 17.6438 | 22.9879 | 28.3641 | 33.7439 | 39.0993 | 44.4556 | 49.8088 | 55.1616 |
| ORBexpress Float | 0.80377 | 2.7818 | 4.83457 | 6.88313 | 8.87832 | 10.9449 | 13.0192 | 15.0331 | 17.1091 | 19.1057 | 21.2346 |
| ORBex Record | 0.81414 | 3.0244 | 5.33684 | 7.63177 | 9.90937 | 12.2055 | 14.5128 | 16.8025 | 19.1224 | 21.392 | 23.7307 |
| ORBex NA Record | 0.84416 | 3.68807 | 6.60806 | 9.58384 | 12.5116 | 15.4598 | 18.4299 | 21.3694 | 24.3317 | 27.2819 | 30.2798 |
| TAO Float | 1.2556 | 3.29115 | 5.22876 | 7.28047 | 9.27898 | 11.3399 | 13.4171 | 15.4633 | 17.5274 | 19.5322 | 21.6006 |
| TAO Record | 1.2736 | 3.62006 | 5.90482 | 8.31184 | 10.7522 | 13.208 | 15.627 | 18.104 | 20.4338 | 22.857 | 25.4183 |
| TAO NA Record | 1.31031 | 4.31163 | 7.38014 | 10.5463 | 13.7382 | 17.0256 | 20.2691 | 23.3544 | 26.5309 | 29.5764 | 32.7332 |

Figure 2. Call & Return Operations in Networked SPARCs ("Any" Transfers Removed)

- HARDPack exhibits a higher base cost and an incremental cost that is twice as high as for the other two ORBs. Once again, however, interpretation of the HARDPack data is needed. After we reported the results of initial tests in August 1999, the HARDPack vendor informed us that a bug in their basic ORB operations had been discovered. This bug caused the HARDPack server to transmit the incoming message back to the client with each operation, nearly doubling the network transfer times. We were unable to test the fix for this problem, but, if this was indeed the case, later releases may exhibit much better performance. Since network transmission time dominates the elapsed time in these operations, HARDPack operations may run close to twice as fast. As usual, we have to caveat the conclusion: until data integrity problems are repaired, results are suspect. In addition, until IIOP is included in the test, results are valid for a homogenous environment only.

Table 1. Comparative Trends for Call & Return Primitives

| Middleware used | Trend line equations for "float" operations |
|---|---|
| Socket | y = 0.00087x + 0.35983 |
| ORB*express* | y = 0.00085x + 0.70358 |
| TAO | y = 0.00085x + 1.14915 |
| HARDPack | y = 0.00173x + 1.60396 |

## 2.3 Aligned Records

When the data is organized into records, the relationships between the ORBs' performance do not change significantly. Incremental trends show ORB*express* gaining a small incremental performance advantage over TAO in this series. Trend line equations for aligned records appear in Table 2.

Table 2. Comparative Trends for Call & Return Records

| Middleware used | Trend line equations for "record" operations |
|---|---|
| Socket | y = 0.00087x + 0.35983 |
| ORB*express* | y = 0.00096x + 0.70071 |
| TAO | y = 0.00101x + 1.09285 |
| HARDPack | y = 0.00179x + 1.59260 |

## 2.4 Non-aligned Records

Performance on Non-aligned (NA) records continues emerging trends. ORB*express* gains in incremental performance advantage over TAO, while maintaining an advantage in basic overhead. Trend line equations for aligned records appear in Table 3.

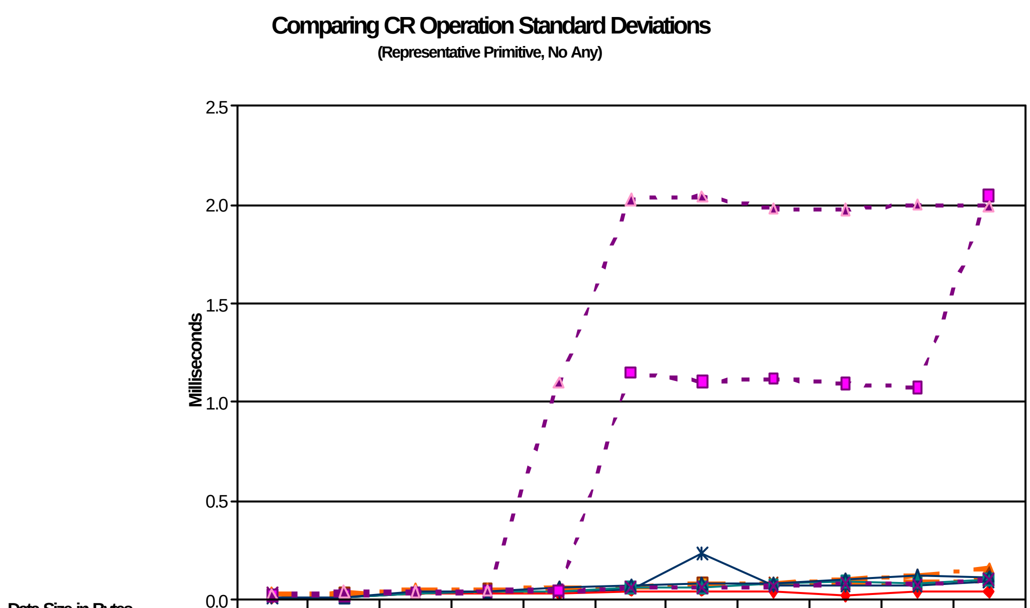
Table 3. Comparative Trends for Call & Return Non-aligned Records

| Middleware used | Trend line equations for "NA record" operations |
|---|---|
| Socket | y = 0.00087x + 0.35983 |
| ORB*express* | y = 0.00123x + 0.68305 |
| TAO | y = 0.00132x + 1.09684 |
| HARDPack | y = 0.00223x + 1.54623 |

## 2.5 Standard Deviations

Figure 3 plots standard deviations calculated for the data sets of the scenario. In these graphs we are looking for data sets with unusual jitter and/or the highest number of or most excessive anomalies.

## Scenario 4: Client, Server on Different Solaris Hosts




| Data Size in Bytes | 144 | 2416 | 4816 | 7216 | 9616 | 12016 | 14416 | 16816 | 19216 | 21616 | 24016 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Socket | 0.0141 | 0.0076 | 0.0354 | 0.0317 | 0.0293 | 0.0453 | 0.0465 | 0.0438 | 0.0223 | 0.0441 | 0.0438 |
| HARDPack Float | 0.0319 | 0.0239 | 0.0359 | 0.0492 | 0.0465 | 0.0656 | 0.0753 | 0.0813 | 0.0849 | 0.0874 | 0.0996 |
| HARDPack Record | 0.0281 | 0.0368 | 0.0321 | 0.0495 | 0.048 | 0.064 | 0.0806 | 0.0788 | 0.0824 | 0.0785 | 0.0988 |
| HARDPack NA Record | 0.0291 | 0.0175 | 0.056 | 0.0501 | 0.0654 | 0.061 | 0.0777 | 0.0856 | 0.1011 | 0.1214 | 0.1581 |
| ORBexpress Float | 0.0124 | 0.0156 | 0.0298 | 0.0398 | 0.0391 | 0.0573 | 0.2362 | 0.068 | 0.0746 | 0.0745 | 0.0899 |
| ORBexpress Record | 0.0169 | 0.0157 | 0.0313 | 0.0436 | 0.0464 | 0.0591 | 0.0651 | 0.078 | 0.0904 | 0.0864 | 0.1034 |
| ORBexpress NA Record | 0.0166 | 0.0135 | 0.0378 | 0.0421 | 0.0641 | 0.0731 | 0.0797 | 0.0835 | 0.1039 | 0.1246 | 0.1168 |
| TAO Float | 0.0342 | 0.0278 | 0.0302 | 0.0411 | 0.0409 | 0.0593 | 0.06 | 0.0688 | 0.0815 | 0.0775 | 0.1008 |
| TAO Record | 0.019 | 0.0246 | 0.0324 | 0.0465 | 0.0486 | 1.152 | 1.1045 | 1.1201 | 1.0928 | 1.0767 | 2.0443 |
| TAO NA Record | 0.029 | 0.0386 | 0.0419 | 0.0464 | 1.1012 | 2.0296 | 2.0437 | 1.9819 | 1.9768 | 2.0018 | 1.9937 |

Figure 3. Standard Deviations for Scenario 4 Selected CR Operations

Between two Solaris/SPARC hosts, we noted higher standard deviations than the norm for TAO runs involving records and non-aligned records. As in the single machine case, a single sample, the first of each series, dominates this standard deviation. The detail data in Figure 4 and Figure 5 show the magnitude of these one-sample hits. By contrast the slightly elevated standard deviation in the ORB*express* float run involves a single mid-run sample exhibiting that is about 3 milliseconds above the nominal measurement, as shown in Figure 6.

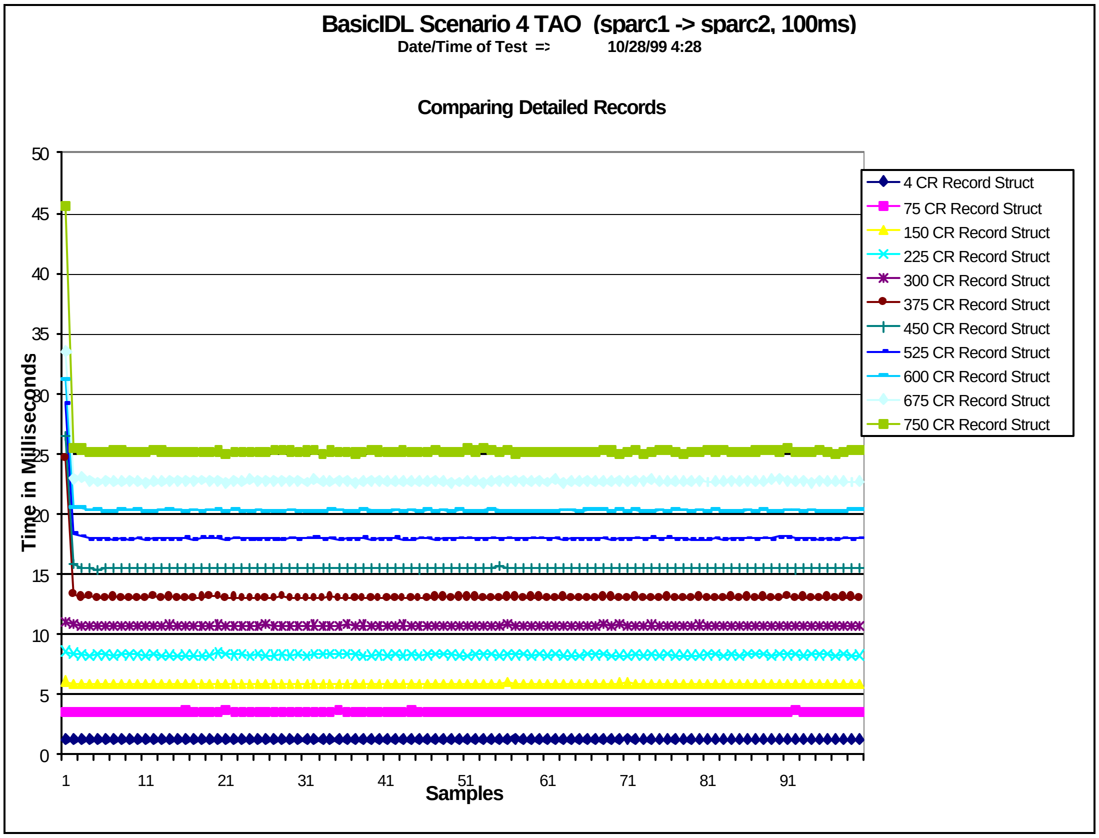



Figure 4. First Sample Anomalies in TAO CR Record Measurements

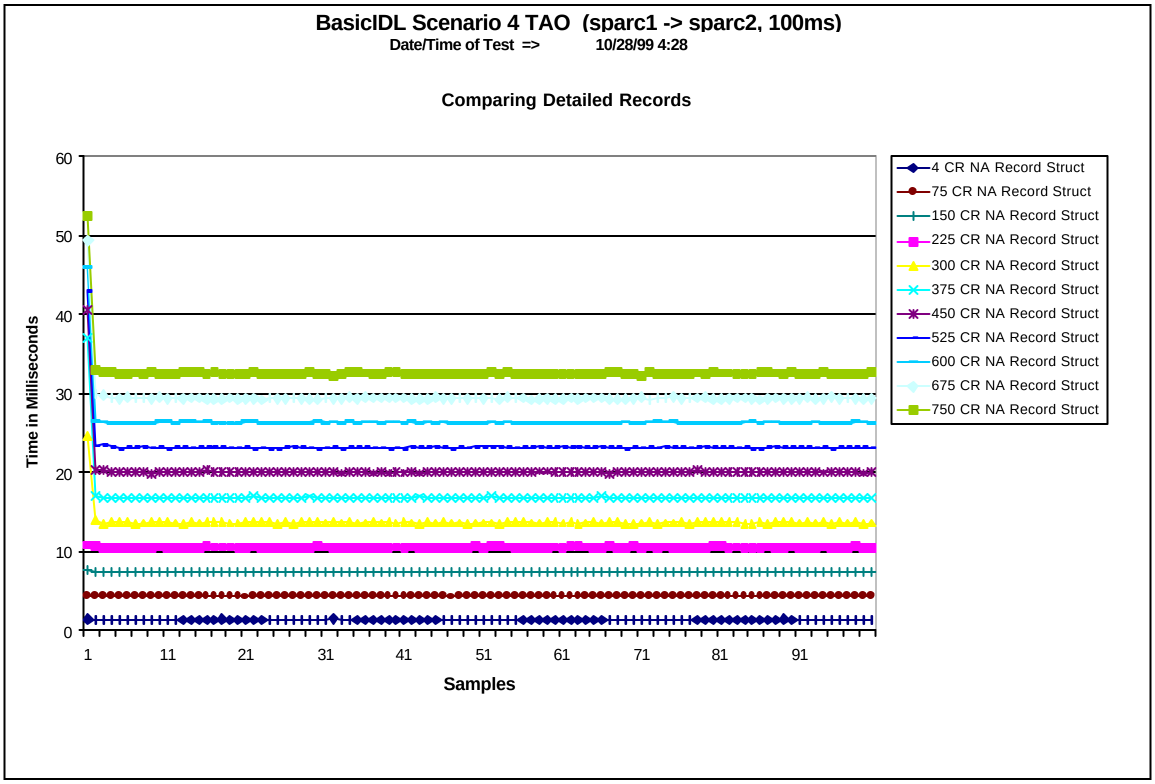



Figure 5. First Sample Anomalies in TAO NA Record Series

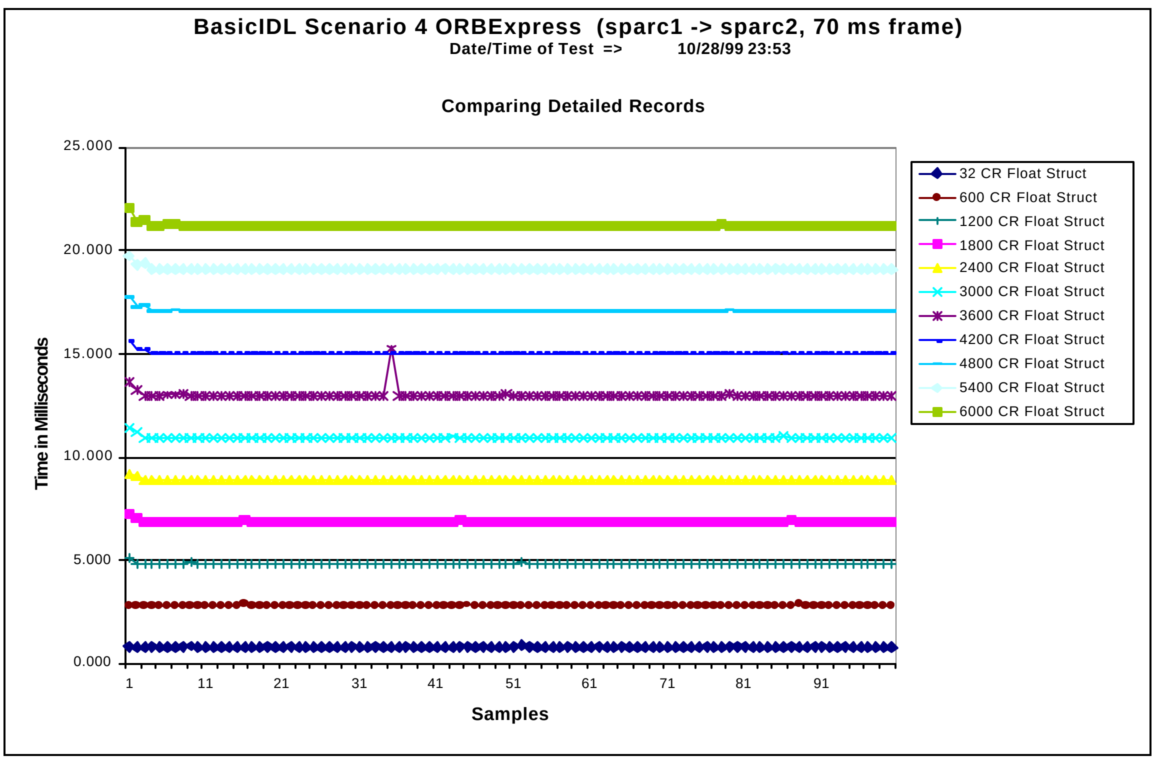
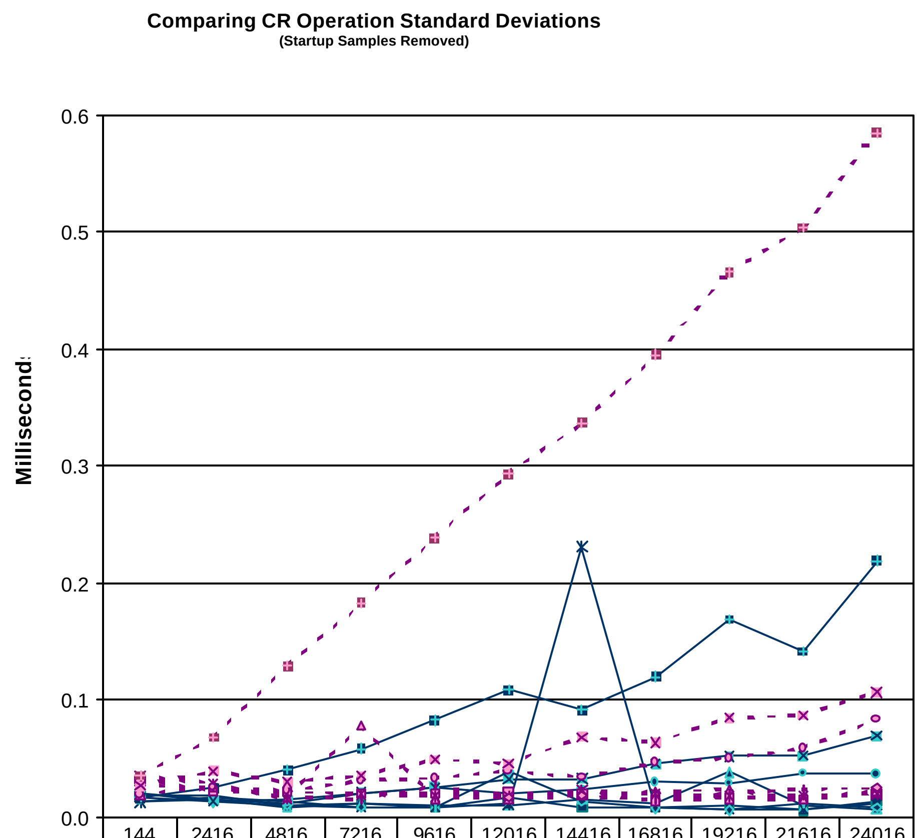



Figure 6. Detailed Measurements for ORB*express* CR Floats

In Figure 7 we removed samples 1 through 5, the startup samples, and show standard deviations calculated on samples 6 through 100 of the data set only. These numbers more accurately capture the variability between operations after the startup costs have been paid.

## Scenario 4: Client, Server on Different Solaris Hosts




| | 144 | 2416 | 4816 | 7216 | 9616 | 12016 | 14416 | 16816 | 19216 | 21616 | 24016 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ORBexpress Short | 0.0178 | 0.018 | 0.0095 | 0.0115 | 0.0089 | 0.0159 | 0.0085 | 0.0085 | 0.0104 | 0.0058 | 0.0138 |
| ORBexpress Long | 0.0206 | 0.0152 | 0.0083 | 0.0108 | 0.0099 | 0.0101 | 0.0154 | 0.0118 | 0.038 | 0.0089 | 0.0067 |
| ORBexpress Float | 0.0125 | 0.0158 | 0.0136 | 0.0081 | 0.0078 | 0.0107 | 0.231 | 0.0077 | 0.0069 | 0.0069 | 0.0106 |
| ORBexpress Double | 0.0205 | 0.0124 | 0.0104 | 0.0088 | 0.0078 | 0.0394 | 0.0139 | 0.0074 | 0.0058 | 0.0118 | 0.008 |
| ORBexpress Record | 0.0128 | 0.0157 | 0.0118 | 0.0193 | 0.0247 | 0.0197 | 0.0236 | 0.0295 | 0.028 | 0.0366 | 0.0364 |
| ORBexpress NA Record | 0.0167 | 0.0137 | 0.0148 | 0.0207 | 0.0255 | 0.0327 | 0.0326 | 0.0451 | 0.0516 | 0.0524 | 0.0691 |
| ORBexpress Any | 0.0162 | 0.0243 | 0.0401 | 0.0582 | 0.0826 | 0.1088 | 0.0917 | 0.1196 | 0.1689 | 0.1417 | 0.2189 |
| TAO Short | 0.0318 | 0.022 | 0.0212 | 0.0202 | 0.0198 | 0.0213 | 0.0193 | 0.0142 | 0.0159 | 0.0146 | 0.0201 |
| TAO Long | 0.0193 | 0.0262 | 0.0169 | 0.0781 | 0.016 | 0.0152 | 0.0182 | 0.0216 | 0.0233 | 0.0153 | 0.0223 |
| TAO Float | 0.0348 | 0.0283 | 0.0148 | 0.0195 | 0.0175 | 0.0186 | 0.0227 | 0.0195 | 0.0175 | 0.0181 | 0.0194 |
| TAO Double | 0.0267 | 0.0252 | 0.0165 | 0.0149 | 0.0267 | 0.0164 | 0.0178 | 0.0153 | 0.0204 | 0.0237 | 0.0246 |
| TAO Record | 0.0192 | 0.025 | 0.0223 | 0.031 | 0.0331 | 0.0392 | 0.0337 | 0.0462 | 0.0503 | 0.0584 | 0.0833 |
| TAO NA Record | 0.0265 | 0.0392 | 0.0296 | 0.0355 | 0.0493 | 0.0455 | 0.0681 | 0.0635 | 0.0847 | 0.0868 | 0.1064 |
| TAO Any | 0.0356 | 0.0681 | 0.1295 | 0.1827 | 0.2386 | 0.2933 | 0.3365 | 0.3948 | 0.4654 | 0.5037 | 0.5844 |

Figure 7. Post Startup CR Standard Deviations

## 2.6 Short Series

The most interesting "aberration" in the Scenario 4 Call & Return data occurs in the Short series, not the "representative" float primitive. For all three ORBs there is a very high first sample cost for five consecutive data sizes for the CR Short run only. This pattern, evident in the signature elevation of standard deviations[1] shown in Figure 8, has appeared in all ORB CR Short measurements taken since we began benchmarks in February, 1999. Since it has occurred with all releases, versions, and patch levels of all ORBs, we attribute this particular anomaly to the release of Solaris (2.6) that we are using. The tests have not yet been run with later releases of Solaris.

**Scenario 4: Client, Server on Different Solaris Hosts**

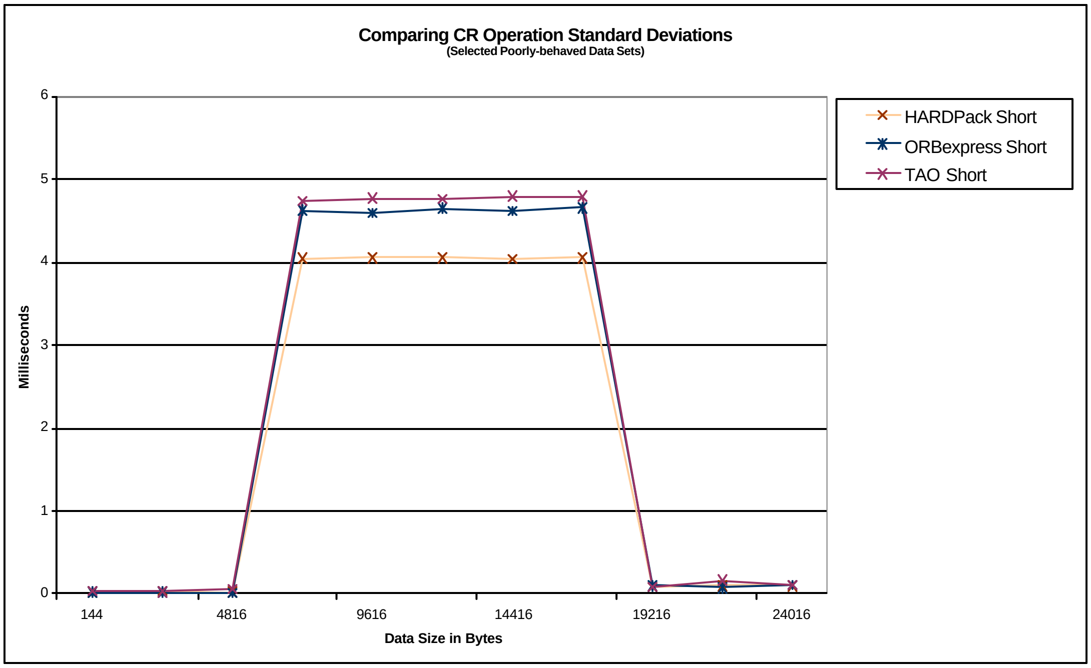


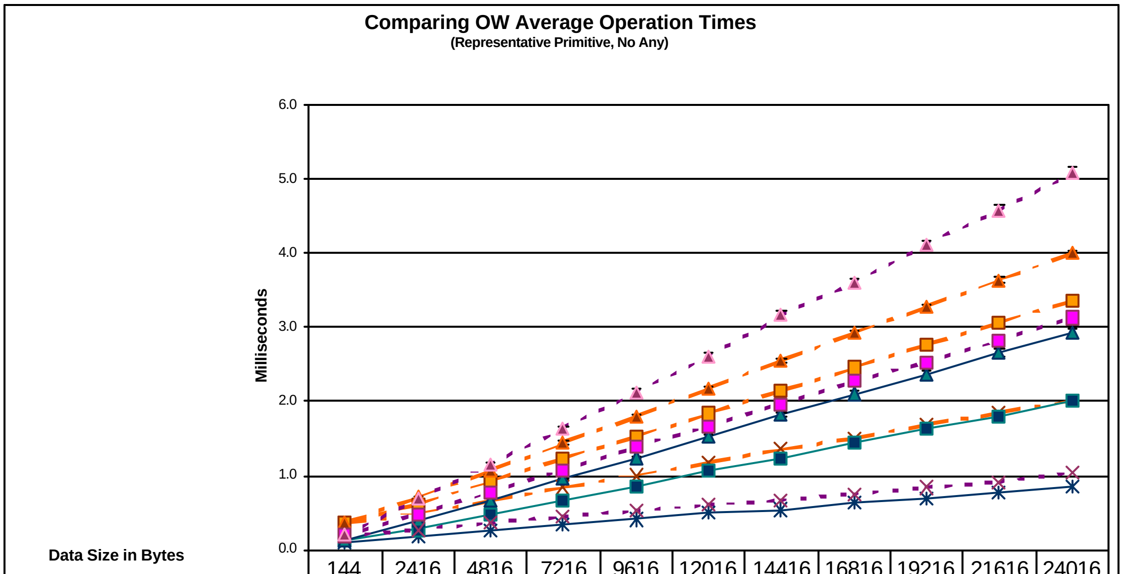

Figure 8. Pattern from First Sample Costs, Shorts under Solaris

[1] This graph is based on the original calculation of standard deviation, including startup samples.

# 3. One-way Operations

As with the Call & Return tests, some of the patterns that were seen in Scenario 1a, a single SPARC environment, change when a network is introduced in the tests of One-way operations. Even though the client side one-way measurement is made before the network transmission occurs, the relative behaviors of the ORBs have changed. As shown in Figure 9, we find that HARDPack now trails ORB*express* and TAO for primitives and records, although TAO performance on NA records continues to lag. Despite the jumbled appearance of the curves in Figure 10, the standard deviations for these series are quite small and indicate generally predictable behavior. Table 4, Table 5, and Table 6 capture the one-way trends.

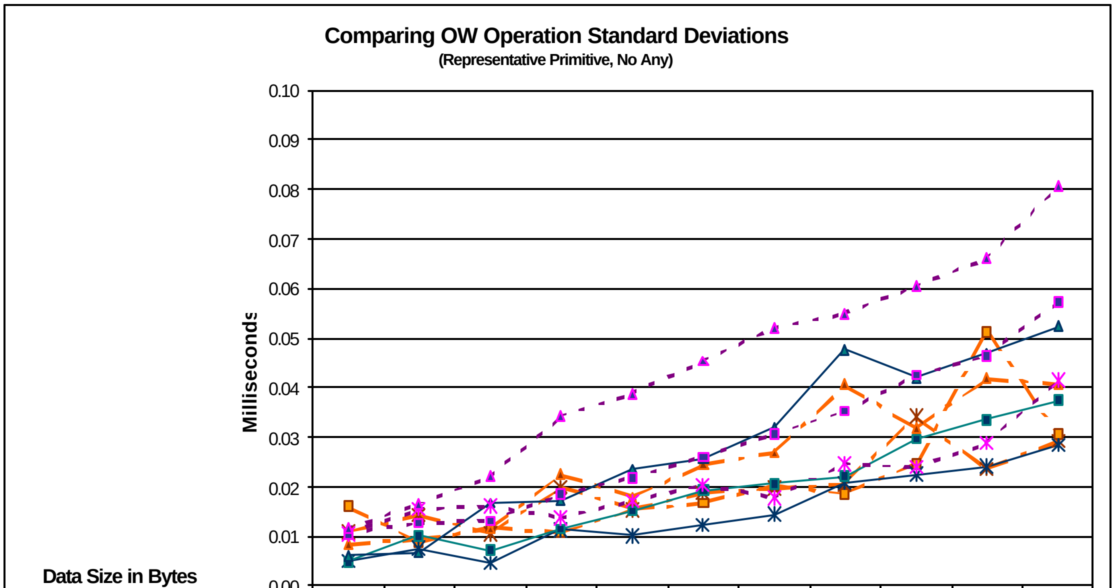
**Scenario 4: Client, Server on Different Solaris Hosts**




| Data Size in Bytes | 144 | 2416 | 4816 | 7216 | 9616 | 12016 | 14416 | 16816 | 19216 | 21616 | 24016 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| HARDPack Float | 0.351 | 0.4861 | 0.6612 | 0.8393 | 0.9987 | 1.1763 | 1.3548 | 1.4996 | 1.6862 | 1.8424 | 2.0138 |
| HARDPack Record | 0.3591 | 0.6194 | 0.9231 | 1.2379 | 1.5261 | 1.834 | 2.1425 | 2.4522 | 2.7657 | 3.0647 | 3.3635 |
| HARDPack NA Record | 0.3607 | 0.7068 | 1.0605 | 1.4365 | 1.7955 | 2.1765 | 2.5521 | 2.9174 | 3.2719 | 3.6349 | 3.9969 |
| ORBexpress Float | 0.1099 | 0.1712 | 0.2546 | 0.3409 | 0.409 | 0.4917 | 0.5398 | 0.6261 | 0.7014 | 0.7651 | 0.853 |
| ORBexpress Record | 0.1132 | 0.275 | 0.476 | 0.671 | 0.8566 | 1.0604 | 1.2246 | 1.4355 | 1.6281 | 1.8011 | 2.0039 |
| ORBexpress NA Record | 0.1177 | 0.3891 | 0.6671 | 0.9491 | 1.2429 | 1.5221 | 1.8161 | 2.1028 | 2.3704 | 2.654 | 2.9254 |
| TAO Float | 0.1849 | 0.2724 | 0.3654 | 0.4477 | 0.5228 | 0.6036 | 0.6673 | 0.7537 | 0.8401 | 0.9126 | 1.046 |
| TAO Record | 0.1909 | 0.4825 | 0.7732 | 1.0767 | 1.3929 | 1.6643 | 1.9653 | 2.2737 | 2.5307 | 2.8234 | 3.1297 |
| TAO NA Record | 0.1974 | 0.6818 | 1.1447 | 1.6375 | 2.1208 | 2.5988 | 3.1638 | 3.599 | 4.1158 | 4.5769 | 5.0744 |

Figure 9. One-way Operations in Networked SPARCs: Average

## Scenario 4: Client, Server on Different Solaris Hosts




| Data Size in Bytes | 144 | 2416 | 4816 | 7216 | 9616 | 12016 | 14416 | 16816 | 19216 | 21616 | 24016 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| HARDPack Float | 0.0109 | 0.0143 | 0.0105 | 0.02 | 0.0154 | 0.0188 | 0.0197 | 0.0205 | 0.0343 | 0.0236 | 0.0293 |
| HARDPack Record | 0.0161 | 0.0087 | 0.0118 | 0.0106 | 0.0154 | 0.0167 | 0.0203 | 0.0185 | 0.0247 | 0.0513 | 0.0307 |
| HARDPack NA Record | 0.0084 | 0.0095 | 0.0115 | 0.0225 | 0.0178 | 0.0245 | 0.0268 | 0.0406 | 0.0318 | 0.0418 | 0.0407 |
| ORBexpress Float | 0.005 | 0.0076 | 0.0046 | 0.0113 | 0.0102 | 0.0123 | 0.0145 | 0.0208 | 0.0225 | 0.0241 | 0.0284 |
| ORBexpress Record | 0.005 | 0.0101 | 0.0071 | 0.0115 | 0.0151 | 0.0192 | 0.0207 | 0.0221 | 0.0296 | 0.0335 | 0.0374 |
| ORBexpress NA Record | 0.0061 | 0.0067 | 0.0168 | 0.0173 | 0.0236 | 0.0256 | 0.0319 | 0.0476 | 0.042 | 0.047 | 0.0524 |
| TAO Float | 0.0106 | 0.0155 | 0.0162 | 0.0137 | 0.0171 | 0.0204 | 0.0177 | 0.0247 | 0.0239 | 0.0288 | 0.0415 |
| TAO Record | 0.0106 | 0.0127 | 0.0131 | 0.0184 | 0.0219 | 0.026 | 0.0307 | 0.0353 | 0.0426 | 0.0464 | 0.0574 |
| TAO NA Record | 0.0116 | 0.0165 | 0.0221 | 0.0343 | 0.0388 | 0.0454 | 0.0521 | 0.055 | 0.0605 | 0.066 | 0.0807 |

Figure 10. One-way Operations in Networked SPARCs: Standard Deviations

Table 4. Comparative Trends in One-way Primitives

| Middleware used | Trend line equations for “float” operations |
|---|---|
| ORB*express* | y = 0.000031x + 0.107025 |
| TAO | y = 0.000034x + 0.188348 |
| HARDPack | y = 0.000070x + 0.329048 |

Table 5. Comparative Trends in One-way Records

| Middleware used | Trend line equations for “Record” operations |
|---|---|
| ORB*express* | y = 0.000079x + 0.094584 |
| TAO | y = 0.000123x + 0.188999 |
| HARDPack | y = 0.000127x + 0.320053 |

Table 6. Comparative Trends in One-way Records

| Middleware used | Trend line equations for "NA Record" operations |
|---|---|
| ORB*express* | y = 0.000118x + 0.103523 |
| TAO | y = 0.000204x + 0.169152 |
| HARDPack | y = 0.000153x + 0.335574 |

# 4. Server Side Data.[2]

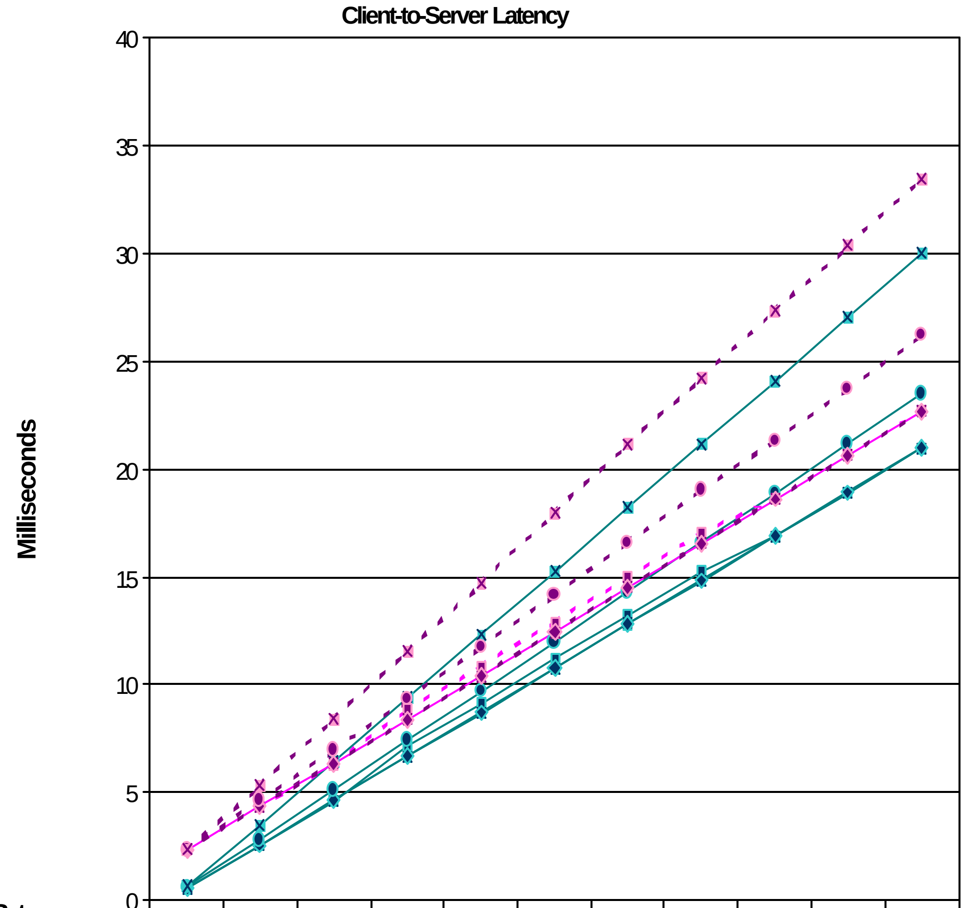
Figure 11, Figure 12, Figure 13 and Figure 14 and display the client-to-server latencies and standard deviations we measured between client and server running in different SPARCs. In reporting this data, we do not adjust the latency for estimated discrepancies between clocks on the client and server machines. Although clocks were synchronized using NTP, we were unable to achieve synchronization accuracy that was adequate to produce adjusted numbers in which we had reasonable confidence.

When the latency data here are compared to the measurements of total CR operation time that appear in Figure 1and Figure 2, some of the latency numbers *exceed* the total operation time. Since the server side time stamp is acquired before the return to the client/requester, these results violate the laws of physics and cannot be accurate. The total operation time as measured in the client must be an upper bound on CR client-server latency. We estimate that the reported latencies in this scenario are on the order of a hundred microseconds on the long side but the data gathered to date does not support a stronger statement. More important for this study than the absolute measurements here are the trends in latency and the predictability of the results.

CORBA Any data has been removed from these graphs to make nuances in other transfers more visible. Even with the scale-warping influence of the Any removed, the results for primitives, by ORB, are so similar that they lie virtually on a single line. The overhead advantages of ORB*express* in client side measurements are reinforced in the server latencies.

[2] Server side latency data was not available for HARDPack runs, so measurements for ORB*express* and TAO only are presented here.

**Scenario 4: Client, Server on Different Solaris Hosts**

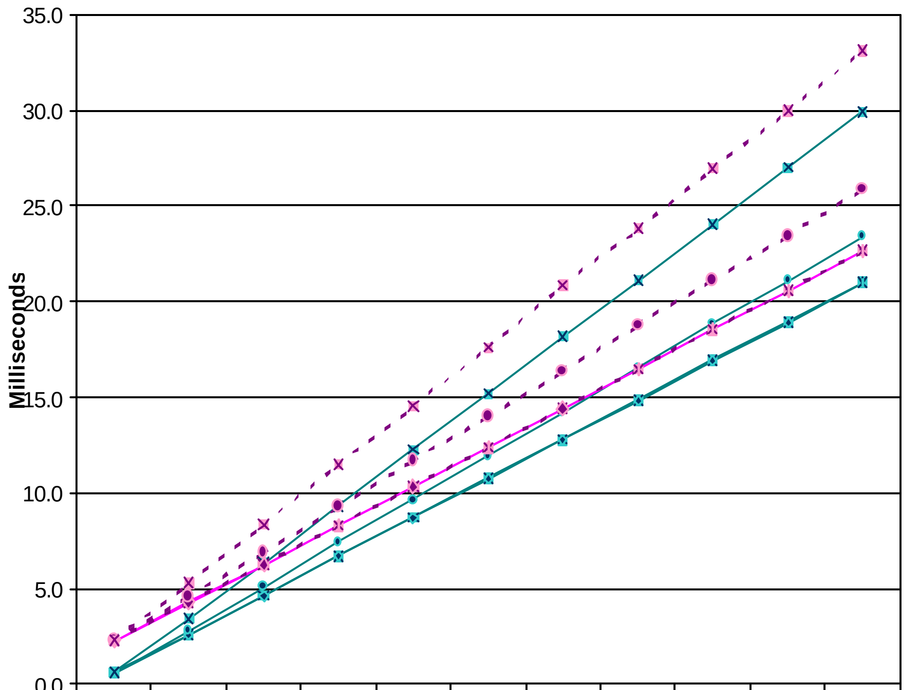



| Data Size in Bytes | 144 | 2416 | 4816 | 7216 | 9616 | 12016 | 14416 | 16816 | 19216 | 21616 | 24016 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ORBexpress CR Short | 0.5485 | 2.5241 | 4.5808 | 7.1167 | 9.1127 | 11.201 | 13.201 | 15.267 | 16.878 | 18.881 | 20.956 |
| ORBexpress CR Long | 0.5656 | 2.5306 | 4.621 | 6.662 | 8.6643 | 10.723 | 12.78 | 14.813 | 16.886 | 18.882 | 20.957 |
| ORBexpress CR Float | 0.5704 | 2.5379 | 4.6262 | 6.6702 | 8.67 | 10.733 | 12.811 | 14.82 | 16.882 | 18.884 | 20.95 |
| ORBexpress CR Double | 0.5713 | 2.5453 | 4.638 | 6.6837 | 8.6878 | 10.749 | 12.8 | 14.835 | 16.902 | 18.906 | 20.973 |
| ORBexpress CR Record | 0.5996 | 2.7964 | 5.1387 | 7.4235 | 9.6943 | 11.982 | 14.29 | 16.574 | 18.886 | 21.147 | 23.473 |
| ORBexpress CR NA Record | 0.6533 | 3.4761 | 6.4211 | 9.3845 | 12.303 | 15.245 | 18.207 | 21.134 | 24.088 | 27.029 | 30.009 |
| TAO CR Short | 2.3297 | 4.3391 | 6.2897 | 8.829 | 10.841 | 12.897 | 14.966 | 17.008 | 18.604 | 20.624 | 22.689 |
| TAO CR Long | 2.3301 | 4.3848 | 6.3363 | 8.3781 | 10.379 | 12.435 | 14.508 | 16.547 | 18.61 | 20.614 | 22.681 |
| TAO CR Float | 2.325 | 4.3445 | 6.3226 | 8.3665 | 10.367 | 12.422 | 14.498 | 16.539 | 18.601 | 20.603 | 22.669 |
| TAO CR Double | 2.3129 | 4.3367 | 6.314 | 8.359 | 10.362 | 12.416 | 14.488 | 16.527 | 18.593 | 20.597 | 22.667 |
| TAO CR Record | 2.3209 | 4.6347 | 6.9467 | 9.3241 | 11.743 | 14.171 | 16.575 | 19.018 | 21.299 | 23.7 | 26.227 |
| TAO CR NA Record | 2.3522 | 5.3151 | 8.4071 | 11.546 | 14.707 | 17.971 | 21.133 | 24.221 | 27.349 | 30.357 | 33.46 |

Figure 11. Client to Server Latency: CR Operations between SPARCs

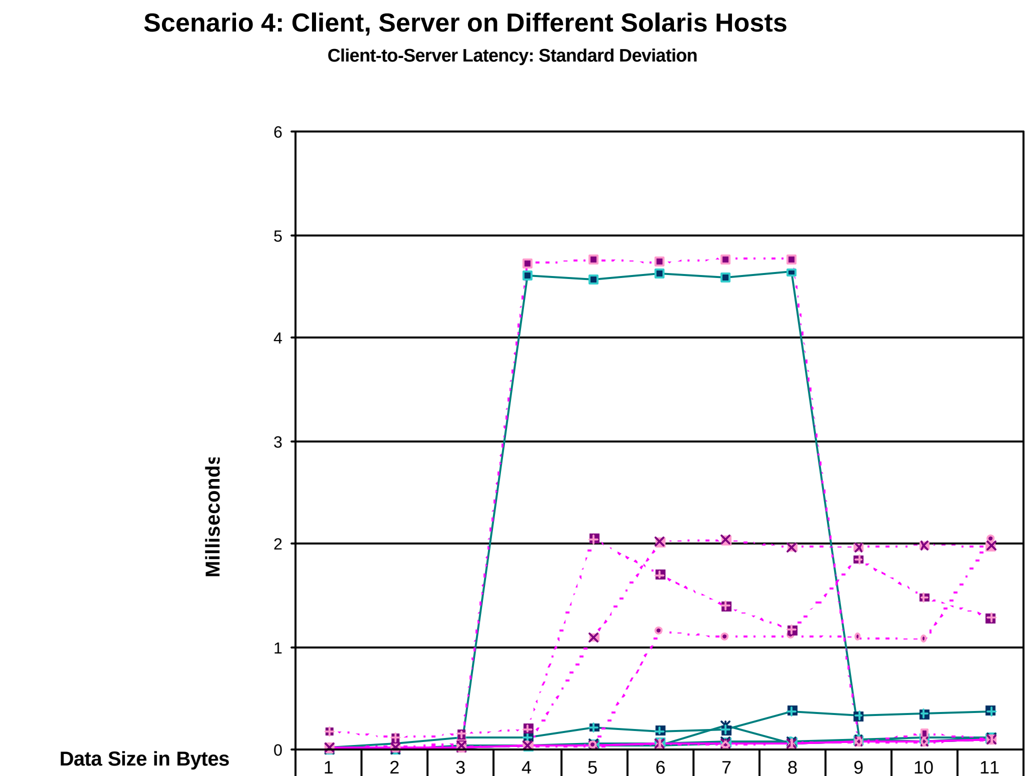
## Scenario 4: Client, Server on Different Solaris Hosts

Average Client-to-Server Latency




| Data Size in Bytes | 144 | 2416 | 4816 | 7216 | 9616 | 12016 | 14416 | 16816 | 19216 | 21616 | 24016 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ORBexpress OW Short | 0.61875 | 2.57866 | 4.63194 | 6.7017 | 8.71537 | 10.7637 | 12.7826 | 14.8445 | 16.9102 | 18.9221 | 20.9809 |
| ORBexpress OW Long | 0.61335 | 2.57404 | 4.63585 | 6.70885 | 8.71249 | 10.779 | 12.8057 | 14.8666 | 16.9302 | 18.9359 | 20.9977 |
| ORBexpress OW Float | 0.62725 | 2.58364 | 4.64109 | 6.71644 | 8.71544 | 10.7805 | 12.795 | 14.8562 | 16.9241 | 18.9261 | 20.9823 |
| ORBexpress OW Double | 0.61594 | 2.57245 | 4.62698 | 6.69465 | 8.68904 | 10.7509 | 12.7669 | 14.8282 | 16.8959 | 18.9048 | 20.9648 |
| ORBexpress OW Record | 0.60547 | 2.77962 | 5.08579 | 7.4132 | 9.63464 | 11.9468 | 14.2118 | 16.5242 | 18.8517 | 21.0902 | 23.4096 |
| ORBexpress OW NA Record | 0.61518 | 3.42706 | 6.37139 | 9.31572 | 12.2634 | 15.205 | 18.1825 | 21.0995 | 24.0381 | 27.0158 | 29.9273 |
| TAO OW Short | 2.2621 | 4.26605 | 6.21669 | 8.28714 | 10.2931 | 12.3588 | 14.3845 | 16.4517 | 18.5254 | 20.528 | 22.6155 |
| TAO OW Long | 2.27228 | 4.26421 | 6.22239 | 8.29206 | 10.3039 | 12.3881 | 14.4035 | 16.4728 | 18.5446 | 20.5478 | 22.6176 |
| TAO OW Float | 2.28427 | 4.28646 | 6.23931 | 8.30978 | 10.3173 | 12.387 | 14.4143 | 16.4778 | 18.5456 | 20.5567 | 22.6619 |
| TAO OW Double | 2.29237 | 4.29386 | 6.25063 | 8.31999 | 10.3277 | 12.3914 | 14.4201 | 16.4855 | 18.5526 | 20.5616 | 22.6331 |
| TAO OW Record | 2.30441 | 4.61285 | 6.88398 | 9.27489 | 11.7291 | 13.978 | 16.3744 | 18.7863 | 21.1355 | 23.4309 | 25.8593 |
| TAO OW NA Record | 2.31167 | 5.28992 | 8.34479 | 11.4911 | 14.5369 | 17.6021 | 20.8682 | 23.8148 | 26.9464 | 29.9669 | 33.1007 |

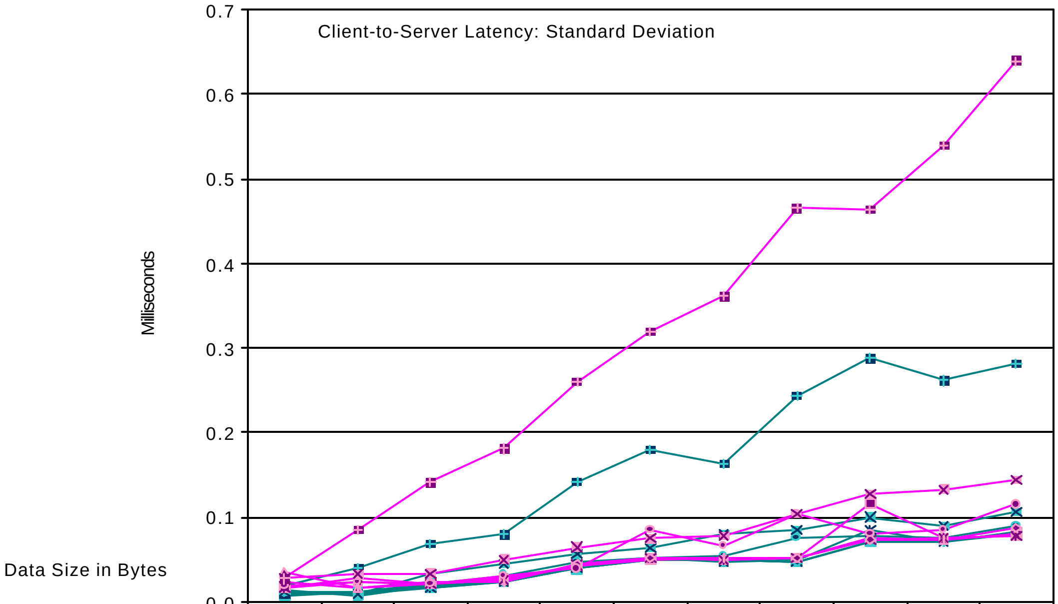
Figure 12. Client to Server Latency: OW Operations between SPARCs




| Data Size in Bytes | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ORBexpress CR Short | 0.0106 | 0.0121 | 0.0181 | 4.6077 | 4.5678 | 4.627 | 4.5957 | 4.637 | 0.0993 | 0.0749 | 0.1126 |
| ORBexpress CR Long | 0.015 | 0.0102 | 0.0265 | 0.038 | 0.0369 | 0.0542 | 0.0558 | 0.0673 | 0.0842 | 0.0784 | 0.0955 |
| ORBexpress CR Float | 0.0095 | 0.0099 | 0.0275 | 0.0374 | 0.0367 | 0.0543 | 0.2339 | 0.0665 | 0.0761 | 0.0745 | 0.0987 |
| ORBexpress CR Double | 0.0117 | 0.0086 | 0.0262 | 0.0372 | 0.0361 | 0.0631 | 0.0553 | 0.0674 | 0.0757 | 0.0753 | 0.0948 |
| ORBexpress CR Record | 0.0094 | 0.0109 | 0.0287 | 0.0409 | 0.0399 | 0.0572 | 0.064 | 0.0767 | 0.0881 | 0.0844 | 0.1004 |
| ORBexpress CR NA Record | 0.0114 | 0.0084 | 0.0362 | 0.0417 | 0.0623 | 0.0712 | 0.077 | 0.0832 | 0.1013 | 0.1227 | 0.1163 |
| ORBexpress CR Any | 0.0237 | 0.0717 | 0.1267 | 0.1235 | 0.2217 | 0.189 | 0.1973 | 0.3832 | 0.3275 | 0.352 | 0.3817 |
| TAO CR Short | 0.0221 | 0.0287 | 0.0629 | 4.728 | 4.753 | 4.7365 | 4.7704 | 4.7705 | 0.077 | 0.1578 | 0.1062 |
| TAO CR Long | 0.0142 | 0.0202 | 0.0271 | 0.039 | 0.037 | 0.0585 | 0.0556 | 0.0675 | 0.0779 | 0.0748 | 0.0942 |
| TAO CR Float | 0.0269 | 0.0192 | 0.0269 | 0.0376 | 0.0388 | 0.0557 | 0.0569 | 0.0672 | 0.0791 | 0.0761 | 0.0968 |
| TAO CR Double | 0.0175 | 0.0281 | 0.0269 | 0.0389 | 0.0387 | 0.066 | 0.0549 | 0.0676 | 0.0764 | 0.076 | 0.0947 |
| TAO CR Record | 0.014 | 0.0174 | 0.0291 | 0.0396 | 0.0479 | 1.1459 | 1.0996 | 1.1145 | 1.0901 | 1.0717 | 2.035 |
| TAO CR NA Record | 0.0245 | 0.035 | 0.0393 | 0.0455 | 1.0949 | 2.0197 | 2.0364 | 1.973 | 1.9668 | 1.9911 | 1.9815 |
| TAO CR Any | 0.1868 | 0.1155 | 0.1508 | 0.2068 | 2.052 | 1.7038 | 1.3981 | 1.1636 | 1.8551 | 1.4843 | 1.2878 |

Figure 13. Client to Server Latency for Scenario 4 CR Operations: Standard Deviations

**Scenario 4: Client, Server on Different Solaris Hosts**



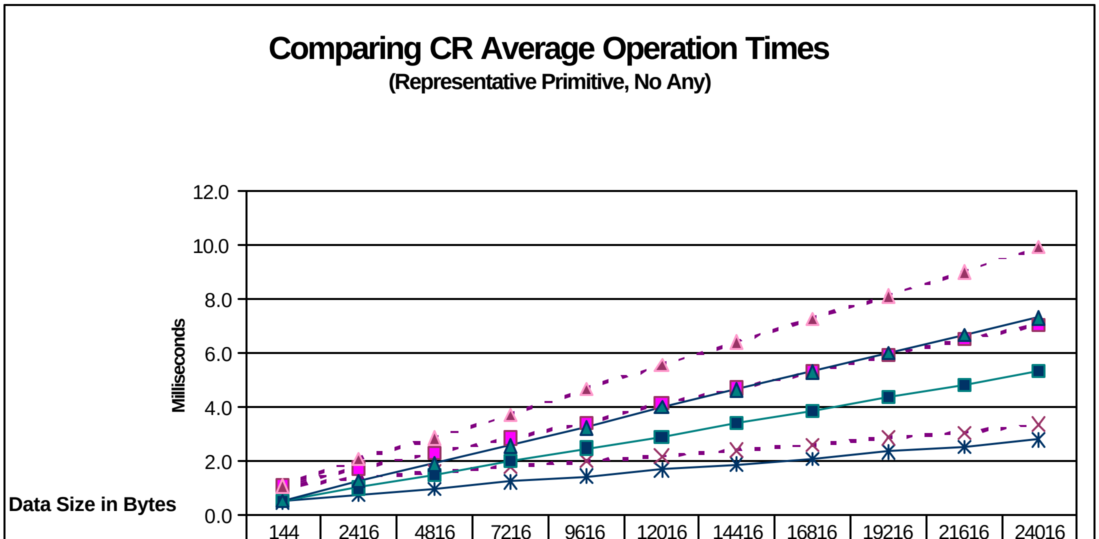

| | 144 | 2416 | 4816 | 7216 | 9616 | 12016 | 14416 | 16816 | 19216 | 21616 | 24016 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ORBexpress OW Short | 0.0077 | 0.0125 | 0.0172 | 0.0242 | 0.0388 | 0.0497 | 0.0485 | 0.0483 | 0.0711 | 0.0721 | 0.0811 |
| ORBexpress OW Long | 0.0129 | 0.0076 | 0.018 | 0.0242 | 0.0406 | 0.0493 | 0.05 | 0.0479 | 0.0714 | 0.0728 | 0.0813 |
| ORBexpress OW Float | 0.0104 | 0.0094 | 0.0163 | 0.024 | 0.0393 | 0.0511 | 0.0482 | 0.0484 | 0.0856 | 0.0715 | 0.0817 |
| ORBexpress OW Double | 0.0117 | 0.0115 | 0.0178 | 0.0261 | 0.0398 | 0.0492 | 0.0485 | 0.0476 | 0.0701 | 0.0716 | 0.0812 |
| ORBexpress OW Record | 0.0111 | 0.0121 | 0.0201 | 0.0318 | 0.0463 | 0.0526 | 0.0539 | 0.0756 | 0.0771 | 0.0762 | 0.0896 |
| ORBexpress OW NA Record | 0.0119 | 0.0082 | 0.0324 | 0.0456 | 0.0561 | 0.0641 | 0.0799 | 0.0847 | 0.1003 | 0.0896 | 0.1066 |
| ORBexpress OW Any | 0.0184 | 0.0401 | 0.0692 | 0.0794 | 0.1421 | 0.1804 | 0.163 | 0.2443 | 0.2877 | 0.2614 | 0.2809 |
| TAO OW Short | 0.0165 | 0.0232 | 0.0212 | 0.0279 | 0.0418 | 0.0528 | 0.0494 | 0.0514 | 0.1168 | 0.0753 | 0.0788 |
| TAO OW Long | 0.0358 | 0.0167 | 0.0213 | 0.0247 | 0.0428 | 0.0491 | 0.0508 | 0.0512 | 0.0755 | 0.0726 | 0.0814 |
| TAO OW Float | 0.0173 | 0.0286 | 0.0217 | 0.0252 | 0.0435 | 0.0519 | 0.0492 | 0.0512 | 0.0727 | 0.0744 | 0.0776 |
| TAO OW Double | 0.024 | 0.0159 | 0.0226 | 0.024 | 0.0439 | 0.0512 | 0.0509 | 0.0517 | 0.0742 | 0.0733 | 0.0881 |
| TAO OW Record | 0.018 | 0.0225 | 0.0211 | 0.0314 | 0.0388 | 0.0855 | 0.0653 | 0.1034 | 0.0804 | 0.0851 | 0.1145 |
| TAO OW NA Record | 0.0288 | 0.0325 | 0.0338 | 0.0504 | 0.0648 | 0.0747 | 0.0776 | 0.1042 | 0.1267 | 0.1333 | 0.1445 |
| TAO OW Any | 0.0271 | 0.0846 | 0.1413 | 0.1807 | 0.2604 | 0.32 | 0.3609 | 0.465 | 0.4635 | 0.5394 | 0.6396 |

Figure 14. Client to Server Latency for Scenario 4 OW Operations: Standard Deviations

# 5. Scenario 4 on a Fast Network

We ran Scenario 4 on a 100BASE-T Ethernet (100Mbits per second) to further isolate the ORB overhead from the network overhead in the measurements of Scenario 4. As shown in Figure 15, the absolute differences and trends between operations in ORB*express* and TAO remain about the same. With a network that is 10 times faster than the 10BASE-T Ethernet used in other tests, however, the ORB overhead begins to dominate the latencies. The lower overhead of ORB*express* shows a much greater percentage advantage in speed over TAO than was evident when the network transfer times dominated the measurement.

**Scenario 4: sparc1 -> sparc2, 70ms frame, 100 base T ethernet**



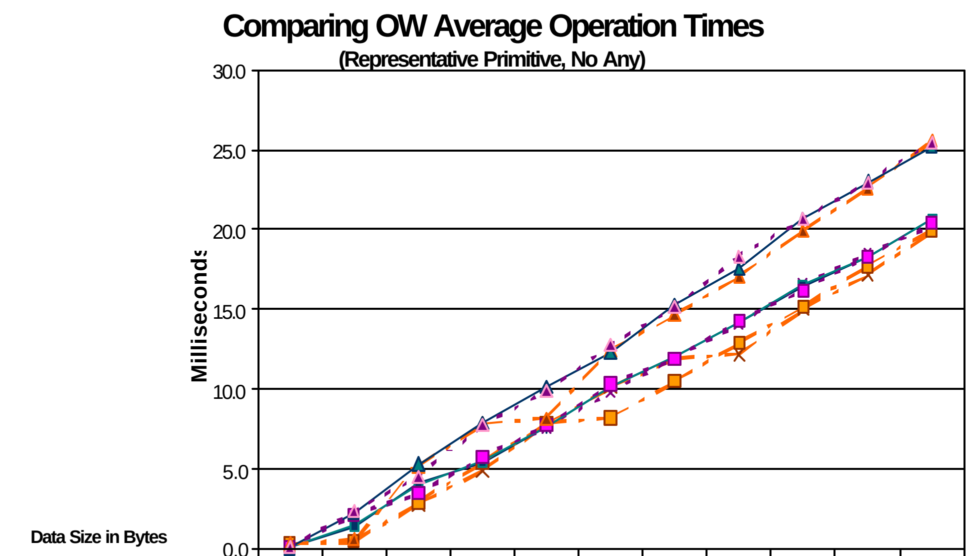

| Data Size in Bytes | 144 | 2416 | 4816 | 7216 | 9616 | 12016 | 14416 | 16816 | 19216 | 21616 | 24016 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ORBexpress Float | 0.47018 | 0.75544 | 0.95244 | 1.20949 | 1.42132 | 1.65686 | 1.86362 | 2.05397 | 2.32687 | 2.51208 | 2.77787 |
| TAO Float | 1.03264 | 1.37631 | 1.56981 | 1.77268 | 1.95789 | 2.15955 | 2.38785 | 2.58118 | 2.83945 | 3.02995 | 3.3438 |
| ORBex Record | 0.47748 | 0.9957 | 1.45309 | 1.96863 | 2.45148 | 2.88029 | 3.38462 | 3.84312 | 4.36679 | 4.80284 | 5.33287 |
| TAO Record | 1.05148 | 1.7308 | 2.29145 | 2.83076 | 3.37901 | 4.12316 | 4.66917 | 5.29081 | 5.89701 | 6.49325 | 7.01665 |
| ORBex NA Record | 0.49032 | 1.22305 | 1.87751 | 2.55204 | 3.20799 | 3.97311 | 4.62193 | 5.27967 | 5.9688 | 6.63819 | 7.29739 |
| TAO NA Record | 1.06199 | 2.06059 | 2.8319 | 3.68005 | 4.66226 | 5.53103 | 6.40856 | 7.24674 | 8.12373 | 9.00195 | 9.90799 |

Figure 15. Scenario 4 Summary Results for 100 Mbit Ethernet

# 6. Overload Behaviors (Scenario 2)

The data presented earlier in this volume documents measured operation times under Solaris in a network environment in which individual operations were isolated temporally. Our Scenario 2 looked at the same operations when operations were attempted with no delay between client requests. Omitting the delay dramatically decreased the performance of One-way operations as can be seen when Figure 16 is compared with Figure 9. The increase in latencies can be seen when Figure 17 is compared with Figure 12. The relentless repetition of operation attempts reflected in Figure 16 caused client requests to build up in the queue before being processed through the ORB and TCP and onto the network. In this overload situation, both average OW operation times and client-to-server latencies degraded. The increase in client-to-server latency was expected, since the time spent in queue prior to transmission is added to the latency of the operation itself. The increasing length of the One-way operation itself indicates that system resources were being stressed through the repeated requests. When queues filled or other resources were exhausted, the system was forced to process queued requests, suspending the ongoing client operation to do so. The result is peak operation times that are orders of magnitude greater than "normal" operation times.

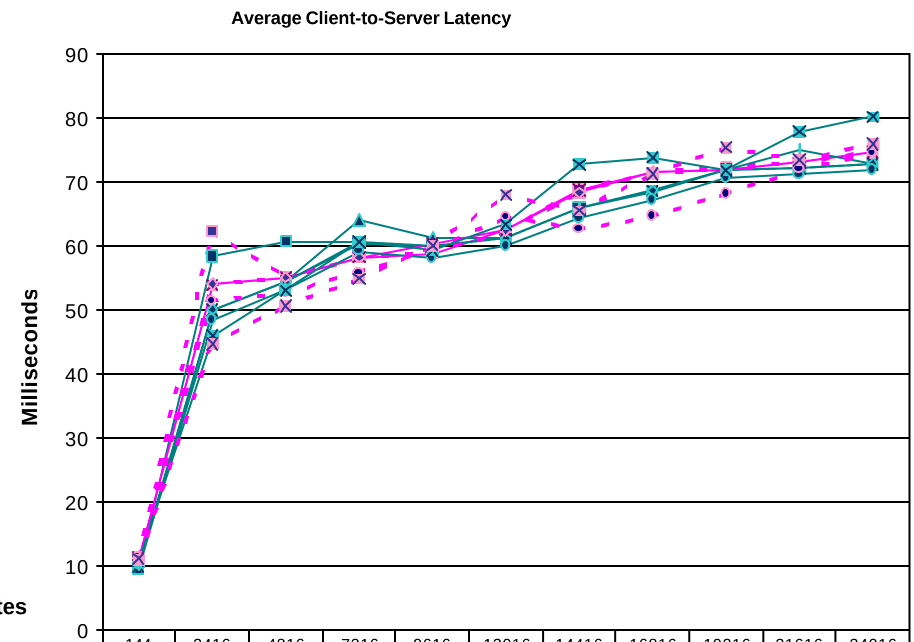
## Scenario 2: Client, Server on Different Solaris Hosts, No Delay




| Data Size in Bytes | 144 | 2416 | 4816 | 7216 | 9616 | 12016 | 14416 | 16816 | 19216 | 21616 | 24016 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| HARDPack Float | 0.3026 | 0.3858 | 2.8121 | 4.9118 | 7.8327 | 10.113 | 11.937 | 12.218 | 15.057 | 17.136 | 19.92 |
| ORBexpress Float | 0.0658 | 1.3952 | 4.1012 | 5.4253 | 7.5881 | 10.132 | 11.977 | 14.175 | 16.483 | 18.25 | 20.682 |
| TAO Float | 0.1238 | 2.1125 | 3.4243 | 5.7228 | 7.5944 | 9.8214 | 11.999 | 14.039 | 16.6 | 18.533 | 20.171 |
| HARDPack Record | 0.3115 | 0.5229 | 2.891 | 5.4149 | 7.8756 | 8.2182 | 10.477 | 12.906 | 15.165 | 17.743 | 19.987 |
| ORBexpress Record | 0.0685 | 1.4433 | 4.0495 | 5.4776 | 7.6399 | 10.161 | 12.016 | 14.211 | 16.505 | 18.295 | 20.706 |
| TAO Record | 0.1289 | 2.141 | 3.5146 | 5.7267 | 7.7335 | 10.35 | 11.887 | 14.325 | 16.214 | 18.325 | 20.441 |
| HARDPack NA Record | 0.3041 | 0.5933 | 5.1697 | 7.8342 | 8.2047 | 12.47 | 14.661 | 17.1 | 19.984 | 22.624 | 25.568 |
| ORBexpress NA Record | 0.0723 | 2.2313 | 5.324 | 7.8914 | 10.167 | 12.333 | 15.335 | 17.564 | 20.709 | 23.004 | 25.214 |
| TAO NA Record | 0.1288 | 2.3377 | 4.5503 | 7.7289 | 9.9081 | 12.76 | 15.156 | 18.34 | 20.666 | 22.985 | 25.497 |

Figure 16. OW Operation Times with Backlog Allowed (Scenario 2)

**Scenario 2: Client, Server on Different Solaris Hosts, No Delay**




| | 144 | 2416 | 4816 | 7216 | 9616 | 12016 | 14416 | 16816 | 19216 | 21616 | 24016 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ORBexpress OW Short | 9.48767 | 58.3215 | 60.6442 | 60.4435 | 59.8149 | 61.0967 | 65.8339 | 68.511 | 71.8196 | 72.1314 | 72.7305 |
| TAO OW Short | 11.1843 | 62.2137 | 54.9421 | 58.1031 | 58.7536 | 62.2476 | 68.6142 | 71.403 | 72.353 | 72.9868 | 74.6287 |
| ORBexpress OW Long | 9.60219 | 49.8437 | 54.2068 | 63.9504 | 61.2443 | 61.0077 | 65.7679 | 68.4762 | 71.7817 | 72.0747 | 72.7111 |
| TAO OW Long | 11.2827 | 53.8335 | 54.9265 | 58.108 | 58.7808 | 62.2544 | 68.2276 | 71.4045 | 71.8484 | 73.0136 | 74.6341 |
| ORBexpress OW Float | 9.87059 | 49.9244 | 54.3156 | 60.3826 | 59.7898 | 61.0683 | 65.8141 | 68.5069 | 71.8239 | 72.1031 | 72.7112 |
| TAO OW Float | 11.1008 | 53.8836 | 54.9452 | 58.1302 | 60.2341 | 62.3054 | 68.6497 | 71.4248 | 71.8701 | 72.9923 | 74.6497 |
| ORBexpress OW Double | 10.0768 | 50.0233 | 54.2215 | 60.4614 | 59.82 | 61.0955 | 65.8445 | 68.5167 | 71.8297 | 74.9655 | 72.7143 |
| TAO OW Double | 11.2238 | 53.9342 | 54.9449 | 58.1658 | 58.8138 | 62.3068 | 68.251 | 71.4438 | 71.8623 | 73.0188 | 74.6594 |
| ORBexpress OW Record | 9.96309 | 48.3649 | 53.0481 | 59.1014 | 58.0771 | 59.9389 | 64.2715 | 67.0671 | 70.5012 | 71.0858 | 71.7983 |
| TAO OW Record | 11.3039 | 51.3528 | 52.4729 | 55.7777 | 59.3581 | 64.3924 | 62.556 | 64.5766 | 68.0352 | 71.8341 | 74.4003 |
| ORBexpr OW NA Record | 10.698 | 45.9725 | 52.942 | 60.5192 | 59.2238 | 63.1903 | 72.6909 | 73.8127 | 71.7177 | 77.8513 | 80.1516 |
| TAO OW NA Record | 10.9882 | 44.6373 | 50.5551 | 54.8033 | 59.9899 | 67.9374 | 65.4259 | 71.1843 | 75.3418 | 73.336 | 75.8453 |

Figure 17. OW Client-to-Server Latencies with Backlog (Scenario 2)

Observations regarding these overload conditions include:

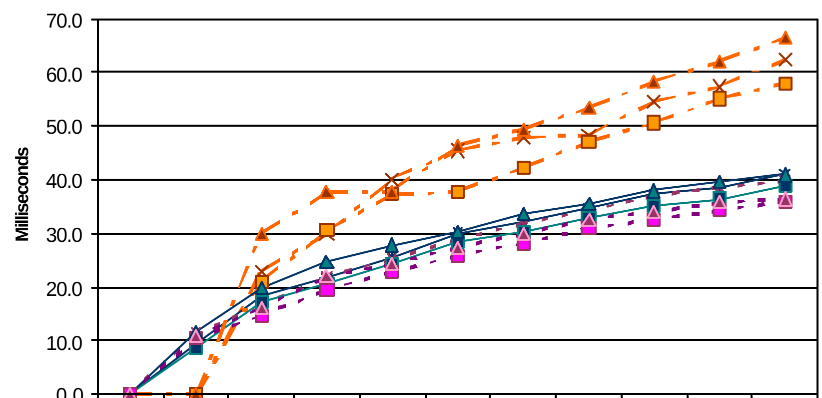
- HARDPack exhibited the lowest average operation times, but higher standard deviations. Review of the detailed records for the executions showed that HARDPack suffered fewer peaks in One-way operation time, but with much higher local maxima than observed in other ORBs. (HARDPack hit peaks of 180 milliseconds to 260 milliseconds in the OW Float operations. ORBexpress and TAO operations reached maximum operation times of approximately 105 milliseconds in the same test sequence. These peaks for TAO and ORB*express* began earlier (inside first five samples versus at the 15$^{th}$ sample) and occurred more frequently (and predictably) than did the HARDPack peaks.
- There is no clear performance distinction between ORB*express* and TAO in terms of average operation time or average client-to-server latency. In some data sets (data type

X message size) ORB*express* has the advantage, TAO in others. TAO often has a lower standard deviation than ORB*express* for the One-way operations as shown in Figure 18. Standard deviations for client-to-server latency exhibited similar tendencies.

**Scenario 2: Client, Server on Different Solaris Hosts, No Delay**

**Comparing OW Operation Standard Deviations**

**(Representative Primitive, No Any)**




| Data Size in Bytes | 144 | 2416 | 4816 | 7216 | 9616 | 12016 | 14416 | 16816 | 19216 | 21616 | 24016 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| HARDPack Float | 0.0678 | 0.031 | 22.799 | 29.989 | 40.091 | 45.389 | 47.728 | 48.313 | 54.452 | 57.302 | 62.292 |
| ORBexpress Float | 0.0887 | 9.1668 | 18.303 | 21.522 | 25.578 | 30.004 | 31.98 | 34.647 | 37.19 | 38.572 | 40.982 |
| TAO Float | 0.0531 | 11.497 | 16.318 | 21.873 | 25.21 | 28.899 | 31.797 | 34.127 | 37.018 | 38.587 | 39.773 |
| HARDPack Record | 0.0593 | 0.0426 | 20.907 | 30.474 | 37.285 | 37.677 | 42.273 | 46.978 | 50.604 | 55.046 | 57.937 |
| ORBexpress Record | 0.0871 | 8.7806 | 17.075 | 20.433 | 24.213 | 28.375 | 30.196 | 32.699 | 35.057 | 36.425 | 38.7 |
| TAO Record | 0.0536 | 10.5 | 14.716 | 19.455 | 22.777 | 25.897 | 28.133 | 30.947 | 32.528 | 34.267 | 35.882 |
| HARDPack NA Record | 0.0447 | 0.1089 | 29.914 | 37.62 | 37.848 | 46.272 | 49.422 | 53.302 | 58.252 | 62.041 | 66.449 |
| ORBexpress NA Record | 0.0811 | 11.73 | 19.737 | 24.702 | 27.813 | 30.351 | 33.581 | 35.525 | 37.928 | 39.575 | 40.909 |
| TAO NA Record | 0.0537 | 10.783 | 16.106 | 21.92 | 24.364 | 27.439 | 29.76 | 32.627 | 33.934 | 35.782 | 36.41 |

Figure 18. OW Operation Standard Deviations with Backlog Allowed (Scenario 2)

The most critical information to be derived from this data may be simply a caution about the extensive use of One-ways and other asynchronous operations: deferring lower priority activities in favor of higher priority activities works only to the extent that total load on the system is understood and managed. Designers must use appropriate system engineering techniques to assure that a system will not break during periods of overload.

# Glossary

| | |
|---|---|
| ACE | ADAPTIVE Communication Environment |
| ADAPTIVE | A Dynamically Assembled Protocol, Transformation and Validation Environment |
| AWACS | Airborne Warning and Control System |
| BDI | Basic data integrity |
| CORBA | Common Object Request Broker Architecture |
| CR | Call and return |
| DII COE | Defense Information Infrastructure Common Operating Environment |
| IDL | Interface definition language |
| IIOP | Internet inter-ORB protocol |
| IPT | Integrated Product Team |
| JTT | Joint Tactical Terminal |
| LMFS | Lockheed Martin Federal Systems (Produces and supports HARDPack) |
| NA | Non-aligned |
| OCI | Object Computing, Inc. (Supports TAO) |
| OIS | Objective Interface Systems (Produces and supports ORB*express*) |
| OMG | Object Management Group |
| ORB | Object request broker |
| OS | Operating system |
| OW | One way |
| POA | Portable Object Adapter |
| PPC | Power PC |
| RT | Real-time |
| RTOS | Real-time operating system |
| TAO | The ACE ORB |
| TWG | Technical Working Group |

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