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Real-time CORBA Trade Study

Volume 3 – Basic IDL Scenario 3a

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1. Introduction

This volume presents the results for Scenario 3a, Client and Server on Single LynxOS/PPC, 70 ms Frame Time. For this scenario, we report comparative data for ORB*express* and TAO only.

2. Call & Return Operations

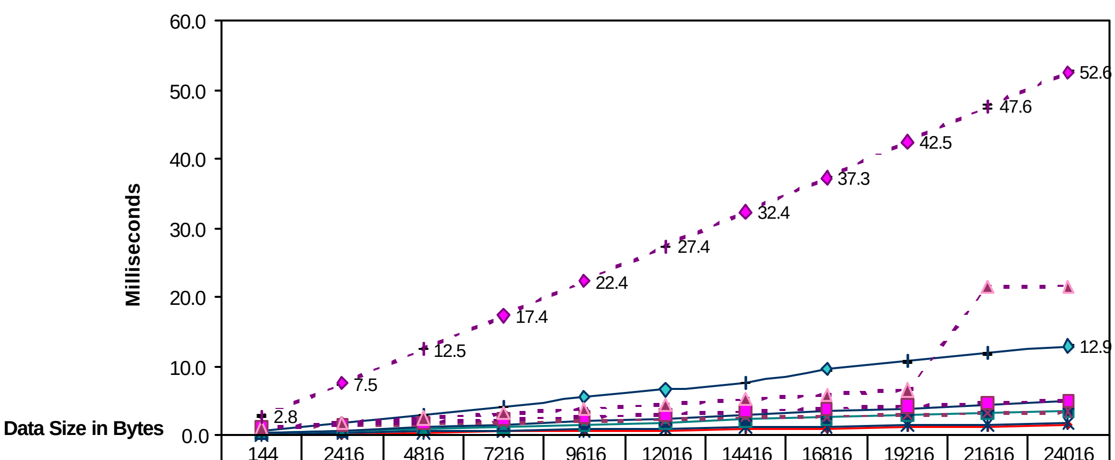
For the Call & Return Operations tests, we report four sets of results: (1) "float" operations as representative of all transfers involving primitive data types, (2) aligned records, (3) non-aligned records and (4) CORBA Any transfers. Graphs throughout this section show performance advantages of ORB*express* over TAO.

2.1 Summary Data: All Transfer Types

Figure 1 summarizes the performance of ORB*express* and TAO when the BasicIDL test executes with client, server, and background processes running on one LynxOS/PPC computer.

Scenario 3a: Client, Server on Single LynxOS/PPC Host

Comparing CR Average Operation Times
(Representative Primitive, No Any)



Data Size in Bytes	144	2416	4816	7216	9616	12016	14416	16816	19216	21616	24016
Socket	0.148487	0.268335	0.386919	0.533959	0.67503	0.790431	0.932164	1.05365	1.171745	1.328243	1.47567
ORBexpress Float	0.268046	0.410845	0.547712	0.705044	0.84019	0.994731	1.193257	1.356207	1.498349	1.694707	1.886447
ORBex Record	0.279018	0.598016	0.908797	1.24808	1.555243	1.893256	2.261981	2.599205	2.92407	3.307526	3.679949
ORBex NA Record	0.284833	0.714848	1.139762	1.57741	2.034374	2.493799	2.936095	3.422236	3.950152	4.399288	4.877934
ORBexpress Any	0.595457	1.810042	3.063043	4.093225	5.559781	6.621098	7.736186	9.593279	10.74521	11.91726	12.94957
TAO Float	1.148254	1.440166	1.65317	1.878051	2.091792	2.32105	2.576549	2.806882	3.030586	3.208456	3.452617
TAO Record	1.160897	1.568839	1.954107	2.33491	2.723393	3.092841	3.50226	3.925752	4.29206	4.698421	5.117357
TAO NA Record	1.170306	1.868029	2.528409	3.193407	3.877761	4.540796	5.24115	5.905589	6.610025	21.48919	21.61954
TAO Any	2.770833	7.508722	12.46682	17.3954	22.36511	27.36692	32.38632	37.30692	42.52494	47.6488	52.63154

Figure 1. Call & Return Operations in Single LynxOS/PPC: Average

Each of the lines in the graph captures the *average* operation time for messages of increasing size for transfers involving a particular data type. Socket data plus representative ORB operations 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. 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, any error bars in the graphs of this section depict an interval of one standard deviation around the mean observed operation time. We use these bars to visually flag test runs in which something that was relatively “unpredictable” happened. In Call & Return operations, however, larger standard deviations occasionally arose from the excessive cost of a single operation in the series, most often the first. With this kind of single peak behavior, the standard deviation error bars do not convey anything significant about operation-to-operation jitter. Rather, unless otherwise noted, visible bars are best interpreted as meaning that *some* anomalous behavior occurred at some point within the data set.

The summary data in the figure provides a few fairly obvious insights:

1. The CORBA Any transfer method is computationally expensive. The performance implications of this operation should be well understood and traded against the need for flexibility as part of a system design process.
2. ORB*express* outperforms TAO on Any transfers by a significant margin. (We found this advantage to hold across all test scenarios.)
3. TAO exhibits some problems in the handling of larger-sized NA Records. Figure 2 shows the single data samples that skewed the TAO performance averages and standard deviations for two test sequences: 675 CR NA Record Struct and 750 CR NA Record Struct. At this time, we can offer no explanation of the cause of these two peaks. Unless otherwise noted, these two test runs will be omitted from the rest of the graphs in this section to avoid obscuring more subtle behavior patterns in the rest of the data.
4. For other transfer methods, the ORB behaviors are fairly closely grouped. In Figure 1 the grouping is too close to draw any conclusions from this particular graph.

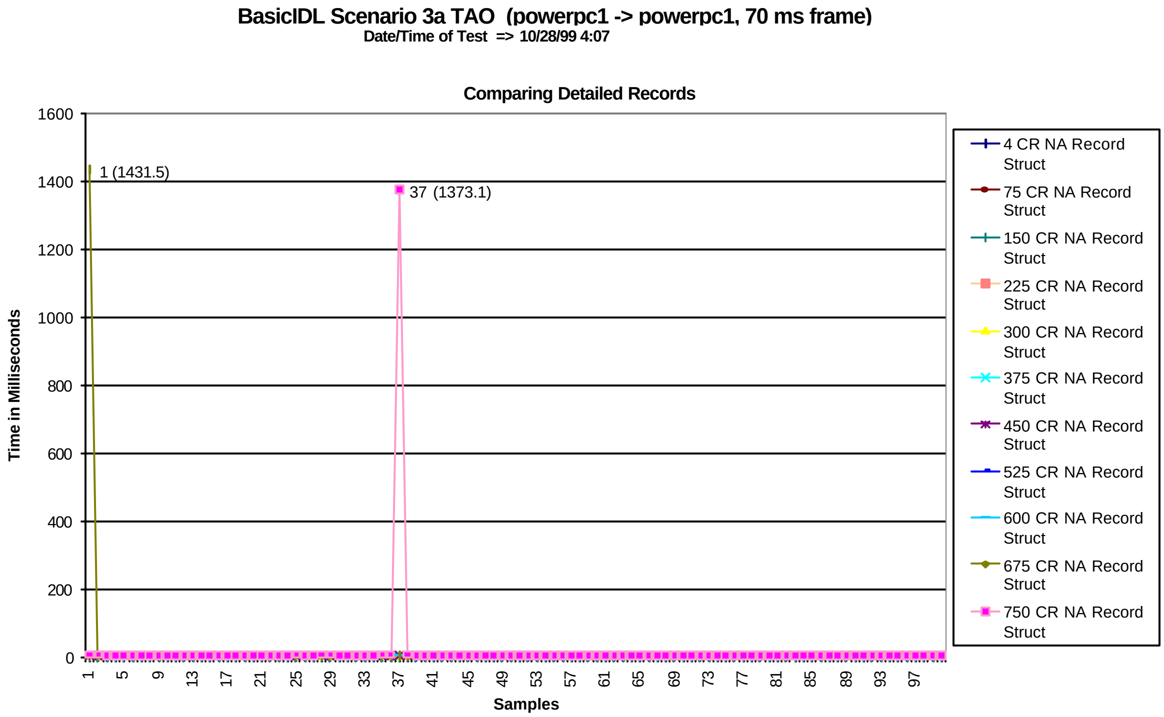


Figure 2. Detail Data for TAO CR NA Record Execution

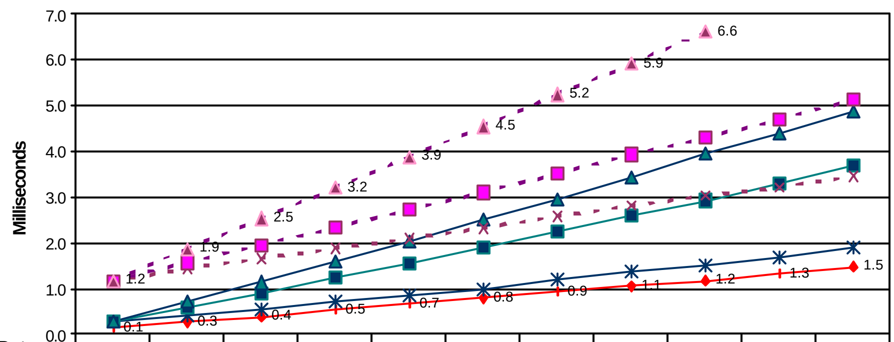
2.2 Primitives and Records

In Figure 3 we remove Any transfers from the summary graph, enabling a closer look at other transfer methods and data types. As we saw in operations in a single Solaris host (Scenario 1a), ORB*express* starts with a lower basic per-operation overhead in all operation types and builds on that performance advantage with a lower cost per data increment. The trend line equations in Table 1 through Table 3 characterize the relative cost of operations using the two ORBs. Socket equations are included for reference.

Scenario 3a: Client, Server on Single LynxOS/PPC Host

Comparing CR Average Operation Times

(Representative Primitive, No Any)



Data Size in Bytes	144	2416	4816	7216	9616	12016	14416	16816	19216	21616	24016
Socket	0.148487	0.268335	0.386919	0.533959	0.67503	0.790431	0.932164	1.05365	1.171745	1.328243	1.47567
ORBexpress Float	0.268046	0.410845	0.547712	0.705044	0.84019	0.994731	1.193257	1.356207	1.498349	1.694707	1.886447
ORBex Record	0.279018	0.598016	0.908797	1.24808	1.555243	1.893256	2.261981	2.599205	2.92407	3.307526	3.679949
ORBex NA Record	0.284833	0.714848	1.139762	1.57741	2.034374	2.493799	2.936095	3.422236	3.950152	4.399288	4.877934
TAO Float	1.148254	1.440166	1.65317	1.878051	2.091792	2.32105	2.576549	2.806882	3.030586	3.208456	3.452617
TAO Record	1.160897	1.568839	1.954107	2.33491	2.723393	3.092841	3.50226	3.925752	4.29206	4.698421	5.117357
TAO NA Record	1.170306	1.868029	2.528409	3.193407	3.877761	4.540796	5.24115	5.905589	6.610025		

Figure 3. Call & Return Operations in Single LynxOS/PPC (Selected Data Removed)

Table 1. Comparative Trends in CR Float Operations

Middleware used	**Trend line equations for “float” operations**
Socket	y = 0.000055x + 0.133341
ORB*express*	y = 0.000067x + 0.225933
TAO	y = 0.000095x + 1.183150

Table 2. Comparative Trends in CR Record Operations

Middleware used	**Trend line equations for “record” operations**
Socket	y = 0.000055x + 0.133341
ORB*express*	y = 0.000142x + 0.228838
TAO	y = 0.000164x + 1.148280

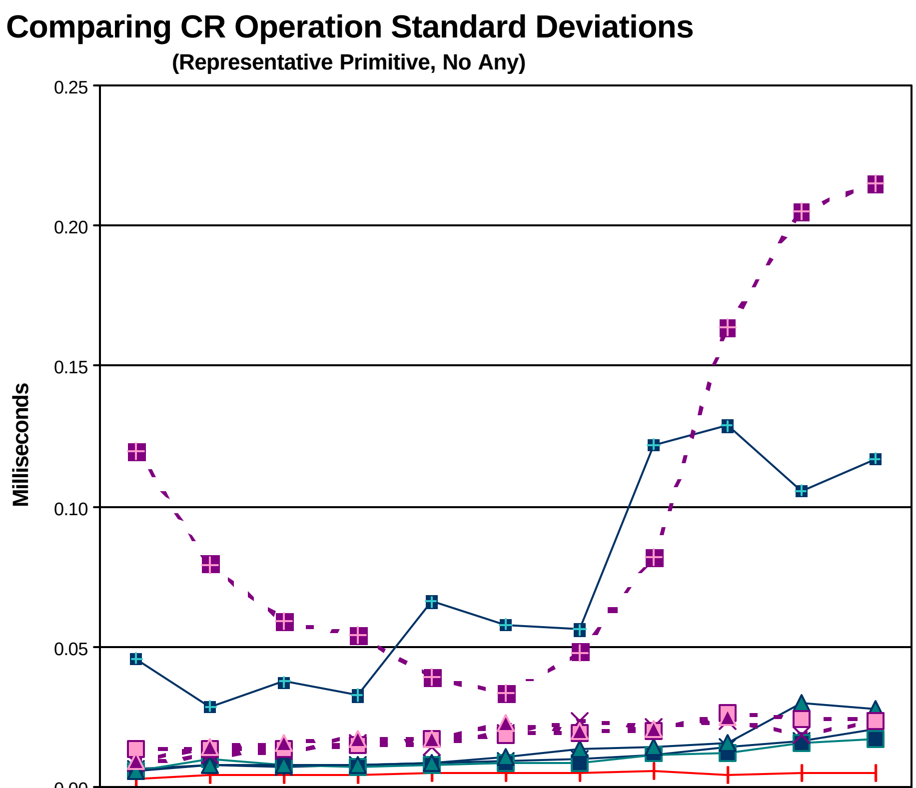
Table 3. Comparative Trends in CR NA Record Operations

Middleware used	**Trend line equations for “record” operations**
Socket	y = 0.000055x + 0.133341
ORB*express*	y = 0.000193x + 0.213315
TAO	y = 0.000283x + 1.153949

2.3 Standard Deviations

Figure 4 plots standard deviations calculated for the data sets of this single LynxOS/PPC scenario. Because of the anomalies noted earlier in this section, the last two data points of the TAO NA Record series have been omitted. With the exception of the data removed, we note no trends of any real significance in this data. The standard deviations are small, and when executed in isolation, these operations in the LynxOS environment are temporally reasonably predictable. In Figure 5 the Any data has been removed to provide better visual reference for the remaining data sets.

Scenario 3a: Client, Server on Single LynxOS/PPC Host



Data Size in Bytes	144	2416	4816	7216	9616	12016	14416	16816	19216	21616	24016
Socket	0.0032	0.0045	0.0046	0.0049	0.0053	0.0053	0.0056	0.0059	0.0048	0.0053	0.0053
ORBexpress Float	0.0066	0.0079	0.0077	0.0082	0.0088	0.0094	0.0103	0.0121	0.0144	0.0168	0.021
ORBexpress Record	0.0062	0.0104	0.0078	0.0078	0.0085	0.0091	0.0087	0.012	0.0122	0.0162	0.0177
ORBexpress NA Record	0.0061	0.0082	0.0082	0.0085	0.0088	0.0112	0.0141	0.0146	0.0161	0.0301	0.0284
ORBexpress Any	0.0462	0.029	0.0377	0.0329	0.0662	0.0582	0.0564	0.1223	0.1288	0.1057	0.1171
TAO Float	0.0086	0.0115	0.0131	0.016	0.0149	0.0198	0.0238	0.0215	0.0241	0.019	0.0236
TAO Record	0.0141	0.0137	0.0137	0.0151	0.0172	0.019	0.0198	0.0203	0.0264	0.0248	0.0241
TAO NA Record	0.0099	0.0146	0.0159	0.0175	0.0171	0.0228	0.0201	0.021	0.0251		
TAO Any	0.1198	0.0795	0.059	0.0543	0.0395	0.0336	0.0483	0.0819	0.1637	0.2051	0.2151

Figure 4. CR Operations in Single LynxOS/PPC: Standard Deviations

Scenario 3a: Client, Server on Single LynxOS/PPC Host

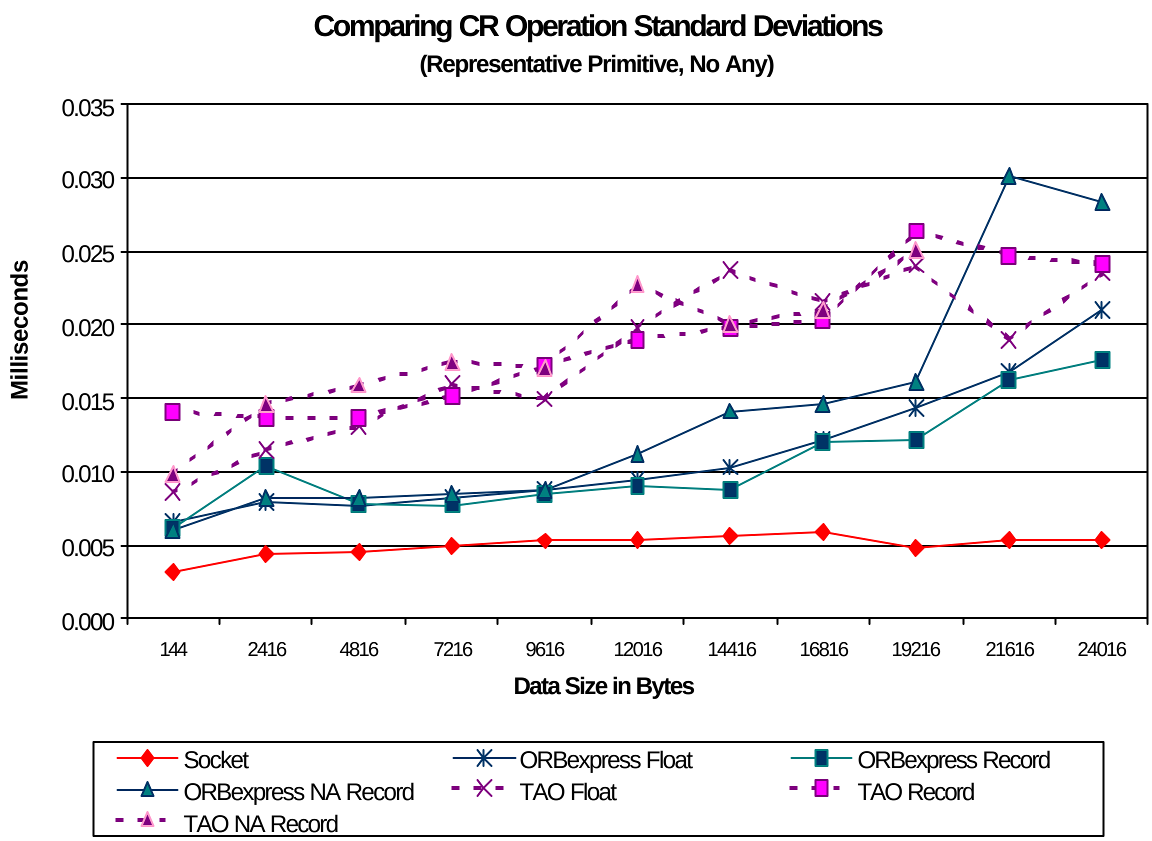
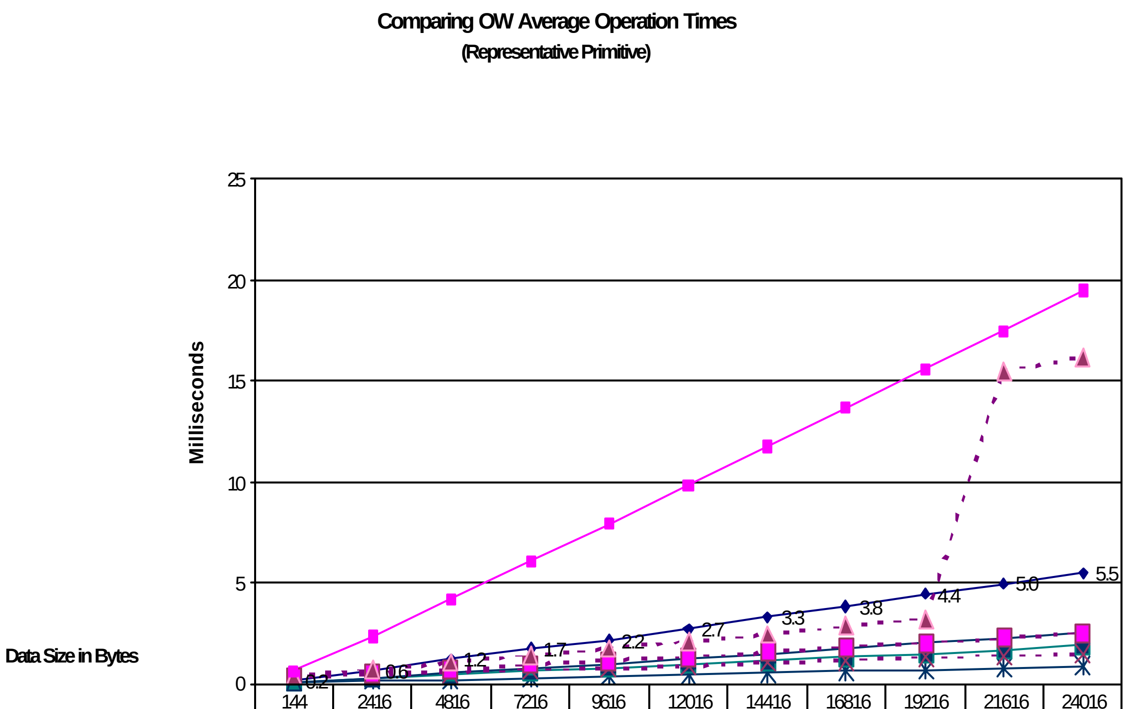


Figure 5. CR Standard Deviations (Any Removed, Graph Only)

3. One-way Operations

Figure 6 shows the average performance of the same set of operations executed in One-way mode in the LynxOS/PPC environment. The poor behavior observed for large non-aligned records using the TAO Call&Return operation (Figure 2) is still present.

Scenario 3a: Client, Server on Single LynxOS/PPC Host



	144	2416	4816	7216	9616	12016	14416	16816	19216	21616	24016
ORBexpress Float	0.071967	0.138845	0.211098	0.294437	0.35608	0.437162	0.551655	0.632215	0.711956	0.812895	0.909898
ORBexpress Record	0.079085	0.23977	0.403357	0.584785	0.739677	0.915213	1.126764	1.310109	1.480173	1.670247	1.86846
ORBexpress NA Record	0.082192	0.297187	0.522399	0.744687	0.975912	1.225789	1.480468	1.712203	1.981681	2.240198	2.507267
ORBexpress Any	0.15052	0.643658	1.179767	1.698235	2.201529	2.733503	3.274587	3.846925	4.421582	4.986291	5.462928
TAO Float	0.316634	0.441096	0.547923	0.667598	0.764156	0.884289	1.010162	1.135671	1.26303	1.347827	1.467309
TAO Record	0.320299	0.509656	0.730357	0.940756	1.131557	1.341816	1.556487	1.790912	1.999538	2.244417	2.48409
TAO NA Record	0.326433	0.669993	1.021651	1.359731	1.723541	2.084609	2.469487	2.834204	3.224027	15.494768	16.115228
TAO Any	0.602135	2.347241	4.199341	6.078836	7.940817	9.788474	11.734659	13.636731	15.549839	17.476951	19.433071

Figure 6. One-way Operations in Single LynxOS/PPC: Average

In Figure 8, these two troublesome data sets have been removed to make the presentation of the rest of the data more clear.

BasicIDL Scenario 3a TAO (powerpc1 -> powerpc1, 70 ms frame)
Date/Time of Test => 10/28/99 4:07

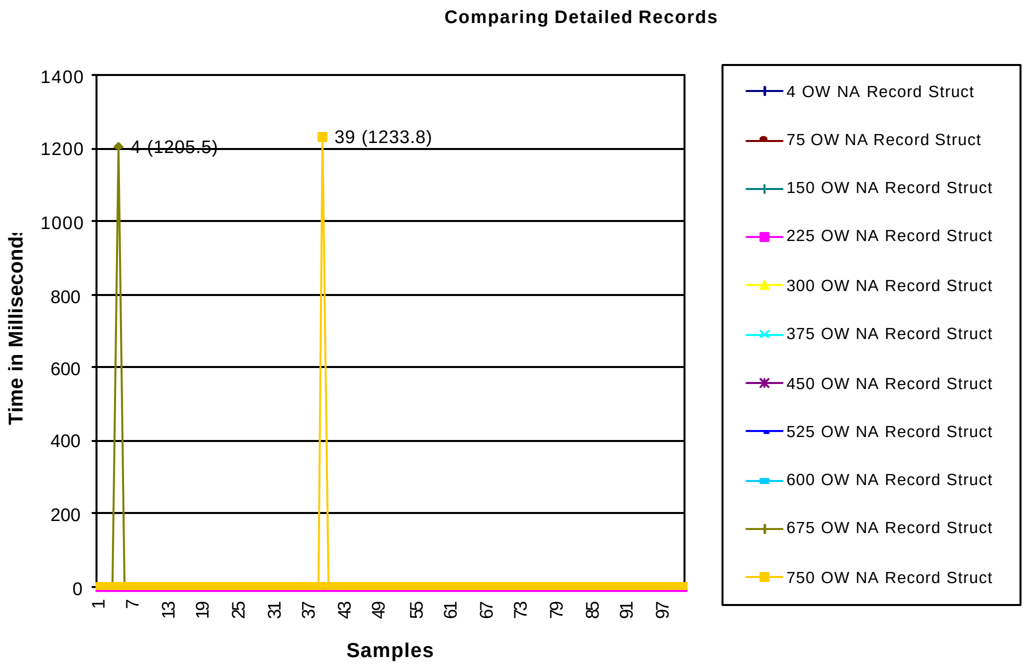
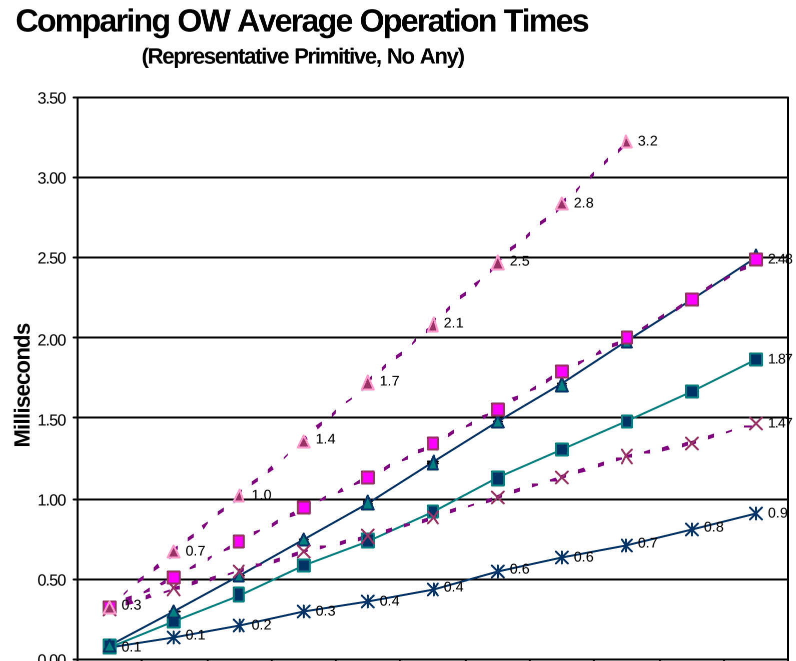


Figure 7. Detail Data for TAO OW NA Record Execution

Scenario 3a: Client, Server on Single LynxOS/PPC Host



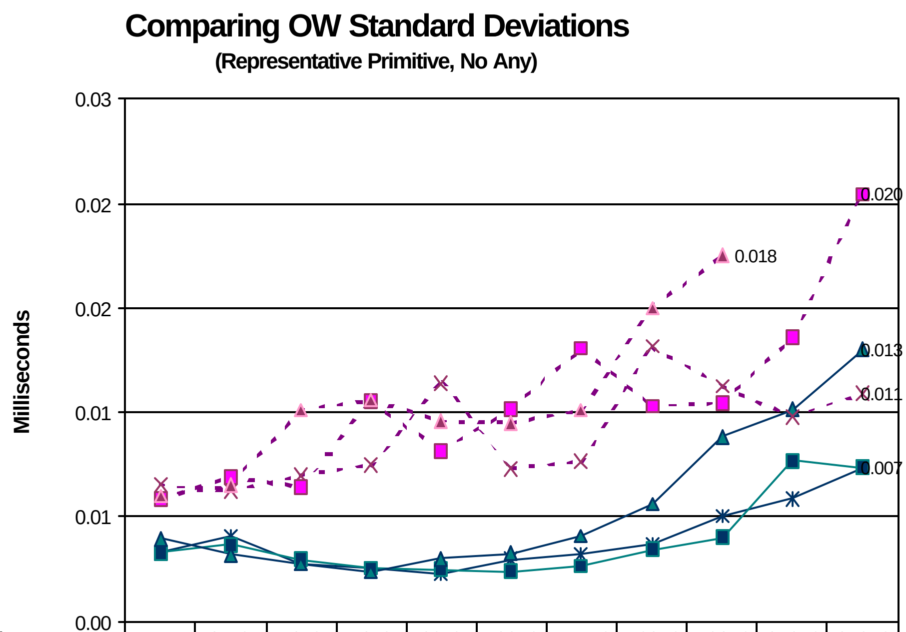
Data Size in Bytes	144	2416	4816	7216	9616	12016	14416	16816	19216	21616	24016
ORBexpress Float	0.072	0.1388	0.2111	0.2944	0.3561	0.4372	0.5517	0.6322	0.712	0.8129	0.9099
ORBexpress Record	0.0791	0.2398	0.4034	0.5848	0.7397	0.9152	1.1268	1.3101	1.4802	1.6702	1.8685
ORBexpress NA Record	0.0822	0.2972	0.5224	0.7447	0.9759	1.2258	1.4805	1.7122	1.9817	2.2402	2.5073
TAO Float	0.3166	0.4411	0.5479	0.6676	0.7642	0.8843	1.0102	1.1357	1.263	1.3478	1.4673
TAO Record	0.3203	0.5097	0.7304	0.9408	1.1316	1.3418	1.5565	1.7909	1.9995	2.2444	2.4841
TAO NA Record	0.3264	0.67	1.0217	1.3597	1.7235	2.0846	2.4695	2.8342	3.224		

Figure 8. Selected One-way Operations in Single LynxOS/PPC: Average

After removing these two aberrant data sets, the standard deviations for the OW operations are plotted in Figure 9. These remain small, attesting to predictable execution of the OW portion of these operations.

Table 4, Table 5, and Table 6 capture the one-way trend equations. Once again the performance advantage of ORB*express* over TAO is evident for all transfer types.

Scenario 3a: Client, Server on Single LynxOS/PPC Host



Data Size in Bytes	144	2416	4816	7216	9616	12016	14416	16816	19216	21616	24016
ORBexpress Float	0.0033	0.0041	0.0027	0.0025	0.0023	0.003	0.0032	0.0037	0.005	0.0059	0.0074
ORBexpress Record	0.0033	0.0037	0.003	0.0025	0.0025	0.0024	0.0026	0.0035	0.004	0.0077	0.0074
ORBexpress NA Record	0.004	0.0032	0.0027	0.0023	0.003	0.0032	0.0041	0.0056	0.0088	0.0101	0.013
TAO Float	0.0065	0.0062	0.007	0.0075	0.0114	0.0073	0.0077	0.0132	0.0113	0.0098	0.0109
TAO Record	0.0059	0.0069	0.0064	0.0105	0.0082	0.0102	0.0131	0.0103	0.0104	0.0136	0.0204
TAO NA Record	0.006	0.0065	0.0101	0.0106	0.0096	0.0095	0.0101	0.015	0.0175		

Figure 9. One-way Operations in Single LynxOS/PPC: Standard Deviations

Table 4. Comparative Trends in One-way Primitives

Middleware used	Trend line equations for “float” operations
ORB*express*	y = 0.000067x + 0.225933
TAO	y = 0.000095x + 1.183150

Table 5. Comparative Trends in One-way Records

Middleware used	Trend line equations for “Record” operations
ORB*express*	y = 0.000142x + 0.228838
TAO	y = 0.000164x + 1.148280

Table 6. Comparative Trends in One-way NA Records

Middleware used	Trend line equations for “NA Record” operations
ORB*express*	y = 0.000193x + 0.213315
TAO	y = 0.000283x + 1.153949

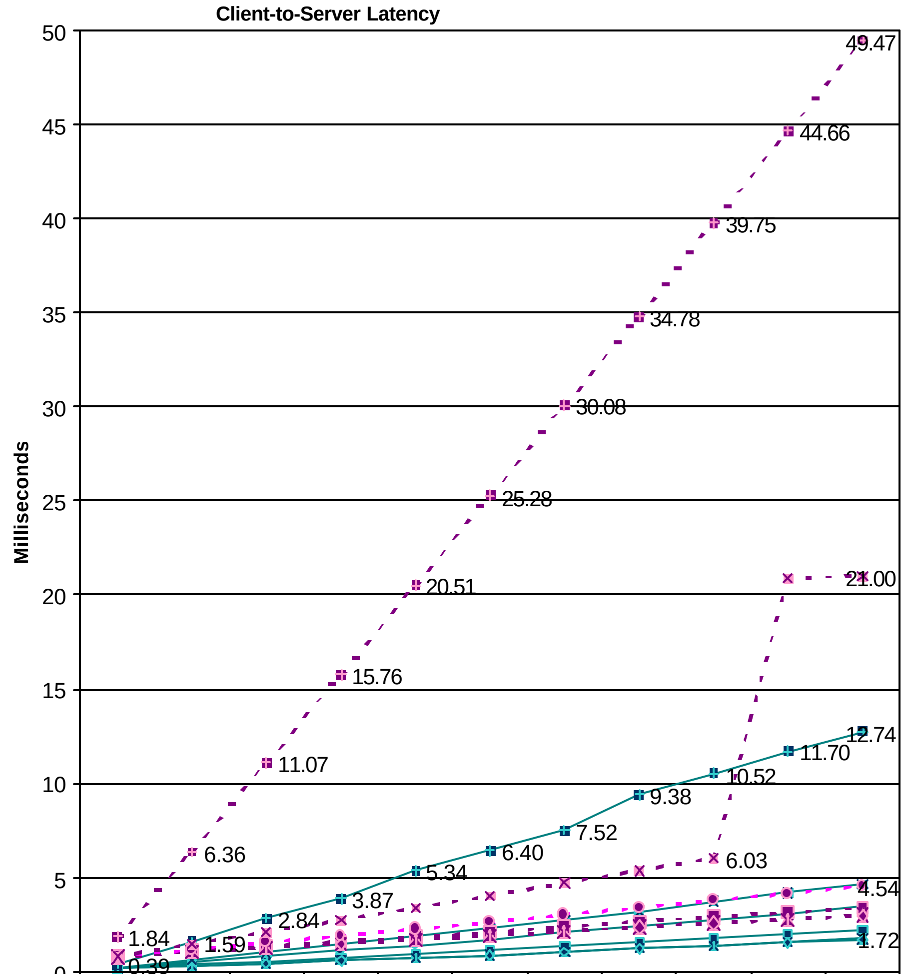
4. Server Side Data

Figure 10, Figure 11, and Figure 13 display the client-to-server latencies we measured between client and server running in a single LynxOS/PPC host. As expected, the performance advantage of ORB*express* is still evident.

The client-to-server latency data provides a little additional insight into the peak operation execution times observed in the TAO NA Record tests. Excessive operation times occurred for two operations in both CR and OW series. At first, the problem appears to materialize at slightly different locations within the CR and OW series: In the CR data, the long execution times affect operations at samples 1 and 37 of the CR NA Record series for 675 transfer units and 750 transfer units, respectively. The excessive operation time doesn't show up in the OW client operation times until the 4^{th} sample of the OW NA Record series at 675 transfer units, the 39^{th} at 750 transfer units. Comparing the detail records for the OW NA Record series (Figure 7) and the related client-to-server latency series (Figure 12), shows that the difficulties did, in fact, begin with the same operations in the CR and OW series. The client-to-server latency data in Figure 12 shows that the activity that introduces the long delays first affects the *completion* of the transfers at samples 1 and 37 for the OW series, too.

The client has higher priority than the server in these scenarios. The latency data from the server side shows that several OW operations (4 and 3, respectively, for the 675 and 750 transfer unit series) are queued on the client side while the excessively long processing to complete the OW operations at samples 1 and 37 is still ongoing. Because the subsequent transfers (2 through 4, 38 through 39) are backlogged on the queue while this processing "glitch" completes, their transfer to the server side is also delayed for an excessive interval. The cause of these anomalies is being pursued with ORB and operating system vendors.

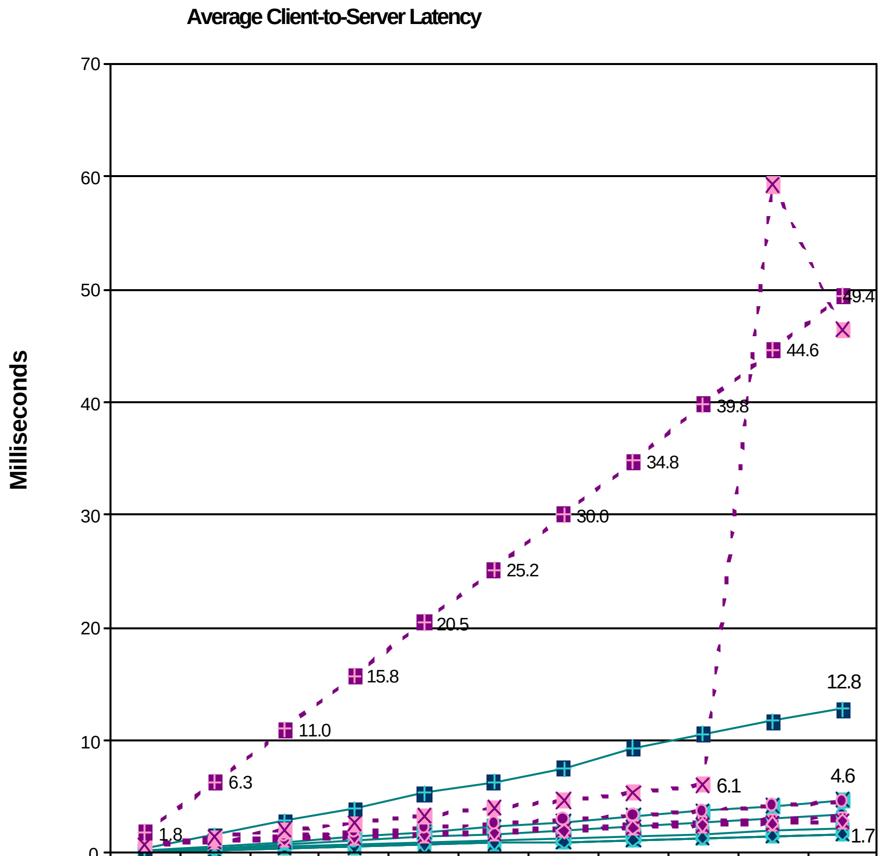
Scenario 3a: Client, Server on Single LynxOS/PPC Host



Data Size in Bytes	144	2416	4816	7216	9616	12016	14416	16816	19216	21616	24016
ORBexpress CR Short	0.1631	0.3602	0.5393	0.7407	0.9198	1.1163	1.3487	1.5522	1.7502	1.9857	2.2226
ORBexpress CR Long	0.1618	0.3065	0.4385	0.5906	0.7201	0.867	1.0651	1.2261	1.3714	1.5571	1.7479
ORBexpress CR Float	0.1618	0.3082	0.4399	0.5894	0.7191	0.8673	1.0618	1.2227	1.3653	1.558	1.7484
ORBexpress CR Double	0.1614	0.3052	0.4348	0.583	0.7146	0.8563	1.0466	1.2027	1.3493	1.5362	1.7193
ORBexpress CR Record	0.1716	0.4838	0.7777	1.099	1.3921	1.7117	2.0666	2.3955	2.7125	3.0762	3.4323
ORBexpress CR NA Record	0.1775	0.5997	1.0048	1.425	1.8661	2.3098	2.7423	3.2106	3.7313	4.1663	4.6301
ORBexpress CR Any	0.3877	1.5921	2.838	3.8705	5.3409	6.3996	7.52	9.3814	10.522	11.697	12.737
TAO CR Short	0.7857	1.0961	1.342	1.5965	1.8208	2.0782	2.3707	2.6367	2.9128	3.1293	3.3683
TAO CR Long	0.7655	1.0496	1.2526	1.4695	1.6751	1.8989	2.1417	2.3581	2.5896	2.7641	3.0025
TAO CR Float	0.7657	1.0528	1.2539	1.4725	1.6762	1.8976	2.141	2.3624	2.5884	2.7646	2.9993
TAO CR Double	0.7661	1.0527	1.2535	1.4682	1.6724	1.8928	2.1307	2.3556	2.5771	2.7516	2.986
TAO CR Record	0.7774	1.1724	1.5327	1.8944	2.2611	2.6112	2.9993	3.4023	3.7593	4.1501	4.5445
TAO CR NA Record	0.788	1.4638	2.0946	2.7351	3.3917	4.0286	4.7085	5.3599	6.0347	20.893	21.002
TAO CR Any	1.8382	6.3569	11.069	15.764	20.509	25.279	30.075	34.78	39.751	44.656	49.468

Figure 10. Client to Server Latency: CR Operations in a Single LynxOS/PPC

Scenario 3a: Client, Server on Single LynxOS/PPC Host



Data Size in Bytes	144	2416	4816	7216	9616	12016	14416	16816	19216	21616	24016
ORBexpress OW Short	0.1601	0.3658	0.5422	0.7418	0.9115	1.1038	1.3332	1.5338	1.7368	1.9635	2.1979
ORBexpress OW Long	0.1595	0.3165	0.4458	0.6019	0.7257	0.8712	1.0641	1.2235	1.3698	1.5524	1.7331
ORBexpress OW Float	0.1584	0.3165	0.4477	0.5987	0.7206	0.8701	1.0565	1.2198	1.3673	1.5561	1.7308
ORBexpress OW Double	0.1588	0.3145	0.4443	0.597	0.7205	0.8669	1.0553	1.2127	1.3653	1.5444	1.7338
ORBexpress OW Record	0.1699	0.4958	0.7947	1.1176	1.4047	1.7257	2.0932	2.417	2.7394	3.0892	3.4431
ORBexpress OW NA Record	0.1761	0.6151	1.0278	1.4463	1.882	2.3444	2.8027	3.253	3.7456	4.2271	4.7174
ORBexpress OW Any	0.4056	1.6038	2.8572	3.9001	5.3113	6.3754	7.498	9.3825	10.58	11.717	12.754
TAO OW Short	0.7201	1.0541	1.2863	1.5426	1.7594	2.0111	2.2747	2.5427	2.7954	3.0137	3.2748
TAO OW Long	0.7153	0.998	1.1933	1.4119	1.5893	1.8026	2.0346	2.2629	2.4861	2.6706	2.8995
TAO OW Float	0.7169	0.997	1.1948	1.4138	1.596	1.8063	2.0371	2.2639	2.4941	2.6728	2.9018
TAO OW Double	0.716	0.9976	1.1932	1.4062	1.5837	1.7954	2.0203	2.2533	2.4797	2.6571	2.8766
TAO OW Record	0.7251	1.1176	1.5056	1.8752	2.2282	2.5954	2.9812	3.387	3.7518	4.1704	4.5756
TAO OW NA Record	0.7369	1.4207	2.0634	2.6919	3.3599	4.0274	4.7055	5.3721	6.0592	59.267	46.439
TAO OW Any	1.8269	6.3167	11.024	15.752	20.471	25.18	29.999	34.792	39.755	44.614	49.424

Figure 11. Client to Server Latency: OW Operations in a single LynxOS/PPC

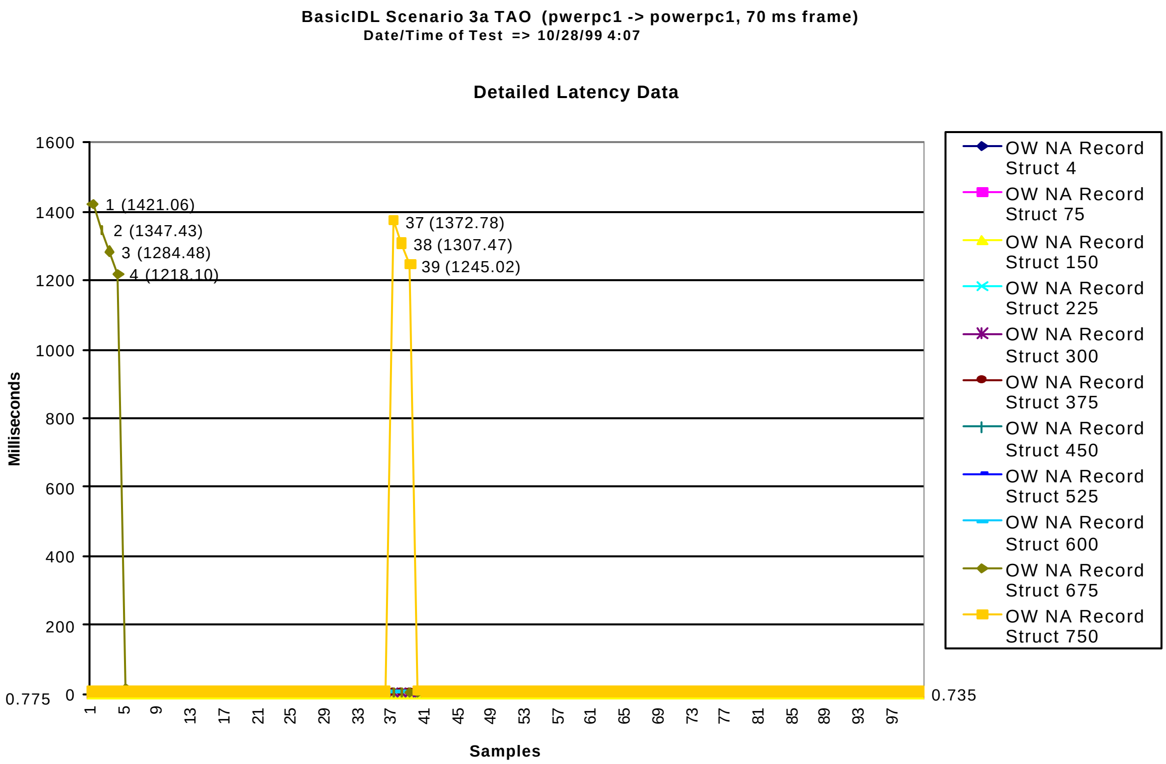
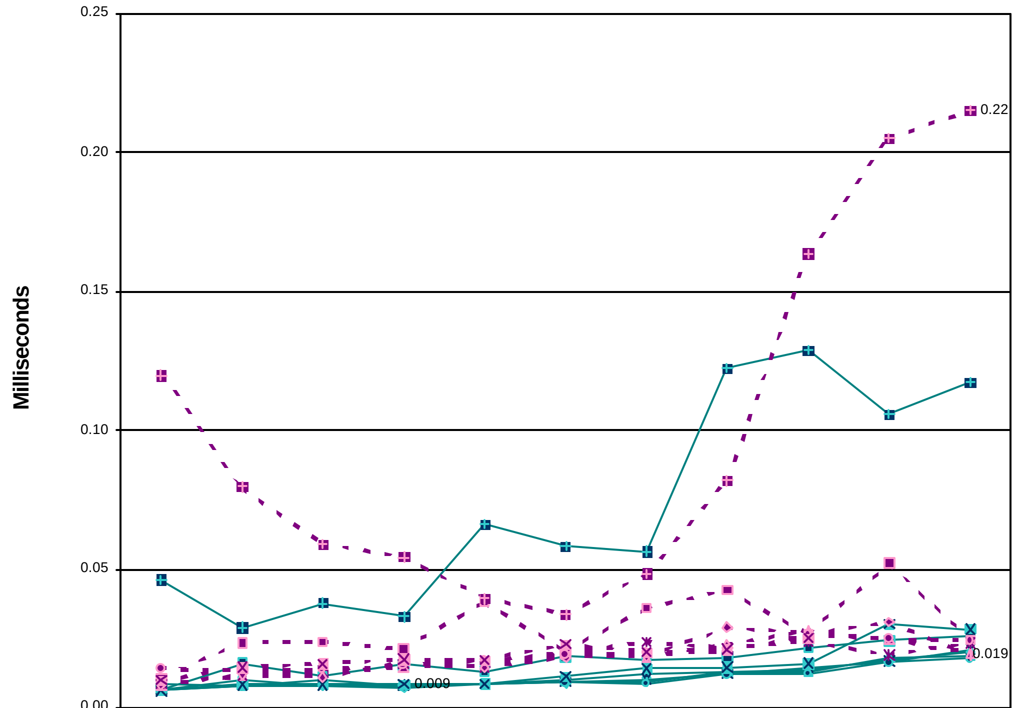


Figure 12. Detail Client-to-Server Latency Data for TAO OW NA Record Execution

Scenario 3a: Client, Server on Single LynxOS/PPC Host

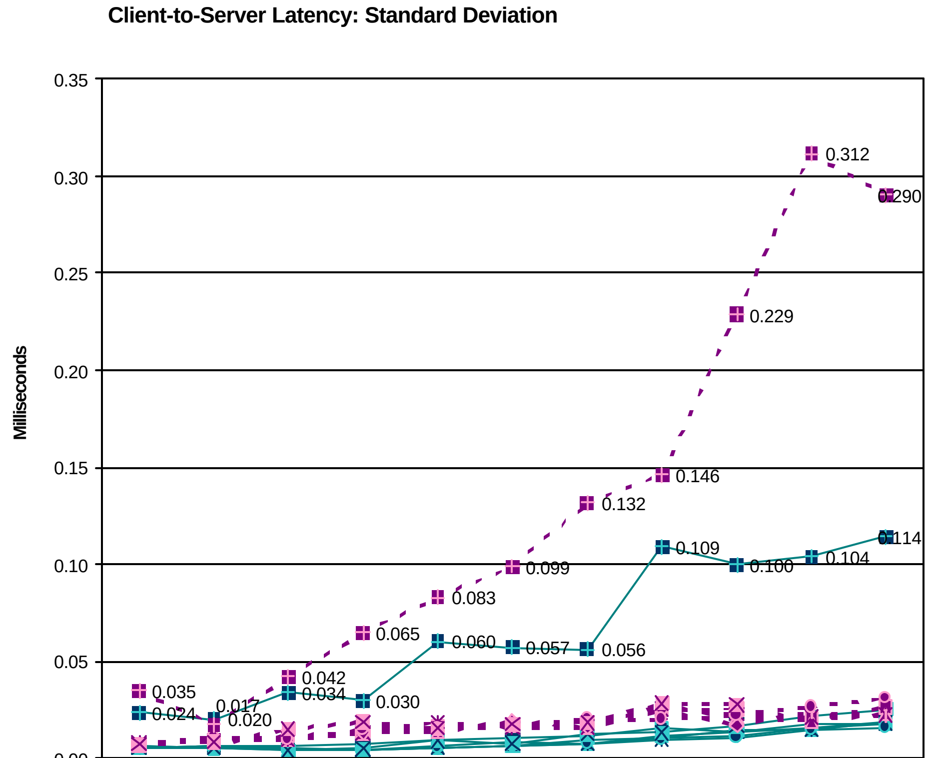
Client-to-Server Latency: Standard Deviation



Data Size in Bytes	140	2412	4812	7212	9612	12012	14412	16812	19212	21612	24012
ORBexpress Short	0.0069	0.0161	0.0113	0.0156	0.0131	0.0185	0.0174	0.0181	0.0214	0.0242	0.0259
ORBexpress Long	0.0065	0.0081	0.01	0.008	0.0087	0.0101	0.0121	0.0131	0.0131	0.0181	0.019
ORBexpress Float	0.0066	0.0079	0.0077	0.0082	0.0088	0.0094	0.0103	0.0121	0.0144	0.0168	0.021
ORBexpress Double	0.0083	0.0079	0.0077	0.0075	0.0085	0.009	0.0094	0.0132	0.0137	0.017	0.0198
ORBexpress Record	0.0062	0.0104	0.0078	0.0078	0.0085	0.0091	0.0087	0.012	0.0122	0.0162	0.0177
ORBexpress NA Record	0.0061	0.0082	0.0082	0.0085	0.0088	0.0112	0.0141	0.0146	0.0161	0.0301	0.0284
ORBexpress Any	0.0462	0.029	0.0377	0.0329	0.0662	0.0582	0.0564	0.1223	0.1288	0.1057	0.1171
TAO Short	0.0109	0.0235	0.0237	0.0211	0.0384	0.0201	0.036	0.0424	0.0265	0.0522	0.0243
TAO Long	0.0084	0.0117	0.0123	0.0147	0.0154	0.0206	0.0178	0.0229	0.0278	0.0248	0.0197
TAO Float	0.0086	0.0115	0.0131	0.016	0.0149	0.0198	0.0238	0.0215	0.0241	0.019	0.0236
TAO Double	0.0083	0.012	0.0111	0.0164	0.0147	0.0181	0.0184	0.029	0.0267	0.0308	0.0189
TAO Record	0.0141	0.0137	0.0137	0.0151	0.0172	0.019	0.0198	0.0203	0.0264	0.0248	0.0241
TAO NA Record	0.0099	0.0146	0.0159	0.0175	0.0171	0.0228	0.0201	0.021	0.0251		
TAO Any	0.1198	0.0795	0.059	0.0543	0.0395	0.0336	0.0483	0.0819	0.1637	0.2051	0.2151

Figure 13. Client to Server Latency for Scenario 3a CR Operations: Standard Deviations

Scenario 3a: Client, Server on Single LynxOS/PPC Host



Data Size in Bytes	144	2416	4816	7216	9616	12016	14416	16816	19216	21616	24016
ORBexpress OW Short	0.0054	0.0069	0.0068	0.008	0.0098	0.011	0.0112	0.0158	0.014	0.0181	0.018
ORBexpress OW Long	0.0062	0.0055	0.0046	0.0045	0.0059	0.0065	0.0078	0.0116	0.0138	0.0155	0.0186
ORBexpress OW Float	0.0054	0.0067	0.004	0.0045	0.0061	0.0084	0.0078	0.0104	0.0144	0.0145	0.0185
ORBexpress OW Double	0.0054	0.0055	0.0055	0.0042	0.0057	0.0066	0.0091	0.011	0.0116	0.0156	0.0183
ORBexpress OW Record	0.0056	0.006	0.0044	0.004	0.0059	0.0069	0.0078	0.01	0.0109	0.0149	0.016
ORBexpress OW NA Record	0.0067	0.0055	0.0041	0.0051	0.0091	0.0077	0.0125	0.0135	0.017	0.0215	0.0253
ORBexpress OW Any	0.0236	0.0201	0.034	0.03	0.0604	0.0573	0.0562	0.1091	0.1	0.1042	0.1142
TAO OW Short	0.0071	0.0089	0.0117	0.0136	0.0161	0.018	0.0188	0.025	0.0256	0.0207	0.0265
TAO OW Long	0.0076	0.0087	0.0096	0.0134	0.0143	0.0171	0.0157	0.0275	0.0207	0.0194	0.0229
TAO OW Float	0.008	0.009	0.01	0.0133	0.0189	0.0157	0.0163	0.0258	0.0228	0.0213	0.0227
TAO OW Double	0.0074	0.0088	0.0114	0.0134	0.0147	0.0191	0.0159	0.0246	0.0172	0.024	0.022
TAO OW Record	0.0069	0.0114	0.01	0.0151	0.0158	0.0174	0.0202	0.0201	0.0222	0.0266	0.0312
TAO OW NA Record	0.0074	0.0086	0.0149	0.0189	0.0156	0.0177	0.0184	0.0285	0.0279		
TAO OW Any	0.035	0.0175	0.0421	0.0648	0.083	0.0991	0.1319	0.1463	0.2289	0.3116	0.2903

Figure 14. Client to Server Latency for Scenario 3a OW Operations: Standard Deviations

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 & 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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