CORBA Comparison Project
Windows Visual C++ Platform

- Orbix 5.1
- TAO 1.2.4
- VisiBroker 5.1

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Both the results of the measurements in this report and their interpretation depend on a number of technical and circumstantial factors. It is the sole responsibility of the user of this report to assess the applicability of the results and their interpretation.

Authors
The Distributed Systems Research Group is a part of the Department of Software Engineering, Faculty of Mathematics and Physics, Charles University, Prague, Czech Republic. The activities of the group include performance evaluation of CORBA broker platforms under the heading of the CORBA Comparison Project. The CORBA Comparison Project commenced in 1998 and has delivered output for partners such as MLC Systeme GmbH (now Deutsche Post Com GmbH), Iona Technologies, Borland International. The group also contributed to the OMG White Paper on Benchmarking.
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Introduction
The purpose of this report is to present results of measurements that evaluate CORBA broker platforms along the three axes of response time, throughput and resource requirements.

Platform Configuration
The Windows Visual C++ platform was configured as follows:
- Dell Precision 340
- Intel Pentium 4 2.2GHz
- 512MB RAM
- 100Mbit/s Full Duplex Ethernet
- Microsoft Windows 2000 Professional SP3
- Microsoft Visual C++ 12.0 SP5

The brokers tested were:
- Orbix 5.1
- TAO 1.2.4
- VisiBroker 5.1

All suites except the Lifecycle Of Servant Instances suite were run remotely. The Lifecycle Of Servant Instances suite was run locally. This was necessary for correlating the timing information from the client with the timing information from the server.

Measurement Technology
Dedicated suites of tests measure individual aspects of broker performance. All suites employ the same measurement framework. To form a specific test, the framework is augmented by an action to be measured on the client side and servants to be instantiated on the server side.

The concept of measurement framework is employed in both the C++ and Java environments. The implementations in both languages are functionally equivalent, except for short explicit garbage collection loop in Java client, which is aimed at ensuring similar starting conditions for each measurement.

Measurement Framework
The measurement framework carries out a measurement in five stages.

Warm-up
In the warm-up stage, the framework instantiates threads that carry out the action to be measured. When the threads start, the framework waits for a random time from 5 to 20 seconds to make sure the system is under a stable load before the measurement progresses.

Client Resource Usage
In the client resource usage stage, the framework collects information about client resource usage in 60 samples taken over the period of 60 seconds. For each resource, the minimum, maximum and average values are kept.

Server Resource Usage
In the server resource usage stage, the framework collects information about server resource usage, same as in the client resource usage stage.

Solo Measurement
In the solo measurement stage, the framework records 5000 individual measurements observed by a randomly selected thread. Information such as statistical distribution and quartiles is calculated from the individual measurements.

Shared Measurement
In the shared measurement stage, the framework records minimum, maximum and average values of measurements observed by all threads over the period of 60 seconds. Information such as overall minima, maxima and averages is calculated from the shared measurements.

Each measurement is repeated 5 times.

Acquiring Time Information
Solaris
On Solaris, the gethrtime() system call is used to obtain the time information. The resolution of thus obtained time is 1ns.

Windows
On Windows, the QueryPerformanceCounter() system call is used to obtain the time information. The resolution of thus obtained time is the same as the frequency of the processor clock.

Acquiring Resource Usage Information
Solaris
The memory usage information on Solaris is collected from the /proc/self/psinfo file, where the resident and swapped application memory sizes are stored, from the kstat structures, where the kernel memory size is stored, from the sysconf() system call, which reports the total physical memory size, and from the swapctl() system call, which reports the total swapped memory size.

The network usage information on Solaris is collected from the kstat structures, where the network traffic information is stored. The network usage information does not include the traffic over the loopback interface in bytes, which is not reported by the operating system.

The processor usage information on Solaris is collected by hooking the thr_create() and pthread_create() system calls, where the application thread count is kept, and from the kstat structures, where the total processor usage is stored.
CORBA Comparison Project, Windows Visual C++ Platform

Windows
On Windows, most information is collected from performance data accessible under HKEY_PERFORMANCE_DATA key in the registry. The data is not actually stored in the registry; the registry functions cause the system to collect the data from its source. The data come in form of performance objects, which represent various resources found in a system. Each object has a name and a set of named counters associated with it. The counters associated with an object can come in several instances for entities where it makes sense, e.g. processes, network interfaces, etc.

The memory usage information is collected from Working Set and Page File Bytes counters of the corresponding instance of Process object, where the resident and swapped application memory sizes are stored, from Pool Paged Bytes and Pool Nonpaged Bytes counters of the Memory object, where the kernel memory sizes are stored and from the GlobalMemoryStatus() system call, which reports the total physical and total swapped memory sizes.

The network usage information is collected from Bytes Sent/sec, Bytes Received/sec, Packets Sent/sec and Packets Received/sec counters of all instances of Network Interface object.

The processor usage information is collected from Thread Count counter of the corresponding instance of Process object, where the application thread count is kept, and from % User Time, % Processor Time and % Privileged Time counters of all instances of Processor object, where the total processor usage is stored.

Java
In Java, the information is collected using native code methods contained in platform dependent dynamic shared libraries, which utilize the above-mentioned methods. The only exception is the application thread count, which is determined using pure Java methods and represents the number of active threads in the root thread group.

Measurement Results
Individual suites of tests are described in dedicated chapters. All chapters begin with a description of the suite accompanied by code fragments that characterize the suite. Except where not applicable, the interface definitions in IDL are present together with the code of the action to be measured on the client side and the code of the servants to be instantiated on the server side.

The results of the tests follow the description in chapters dedicated to individual brokers and platforms. When more than one broker has been tested on a platform, a platform summary is also provided. The results are plotted in graphs accompanied by a description of what the graph shows.

Time Distribution Graphs

![Time Distribution Graph](image)

The time distribution graphs are calculated from data collected in the solo measurement stage. On the X axis are intervals of the time being measured, on the Y axis is the percentage of the measured times that fell within the given interval. The bars marked as other denote measured times that were either smaller or bigger than any of the intervals considered.
**Time Pattern Graphs**

The time pattern graphs are calculated from data collected in the solo measurement stage. On the X axis is the sequential number of the measurement, on the Y axis is the measured time.

**Box And Whiskers Graphs**

The box and whiskers graphs are calculated from data collected in the solo measurement stage. The box spans from low to high quartile of the collected data and thus indicates the range within which half of the measured values fall. The whiskers span from minimum to maximum of the collected data and thus indicate the range within which all of the measured values fall. The median of the collected data is marked within the box.
Resource Usage Graphs

The resource usage graphs are calculated from data collected in the client and server resource usage measurement stages. The solid line marks the average of the collected data. When present, a pair of dotted lines marks the minimum and maximum of the collected data.
**Initial**

**Void**

**Description**

The suite measures an empty cycle of a constant length with a halfway timestamp. The purpose of the suite is to assess the impact of the measurement environment and measurement framework on the observed results.

**C++ Code**

```c++
ulonglong ActionVoid (void *pArgs)
{
    ulonglong    iTime;
    volatile int  i;

    // This is really just a cycle over a volatile variable to
    // waste some time and prevent too aggressive an optimization.

    for (i = 0 ; i < BEN_Cycles ; i ++) { }
    iTime = TIMGetTimestamp ();
    for (i = 0 ; i < BEN_Cycles ; i ++) { }

    return (iTime);
}
```

**Java Code**

```java
public final void execute (long [] times) {
    for (int cntr = 0; cntr < BEN_Cycles; cntr++) { }
    times [0] = SysInformer.timGetTimestamp ();
    for (int cntr = 0; cntr < BEN_Cycles; cntr++) { }
}
```

**Results**

The time distribution graphs should display a maximum for both the half cycle and the full cycle times. The maxima should be almost exclusive when a single thread is used and gradually less dominant when multiple threads are used. The most frequently observed time for the full cycle should be twice the most frequently observed time for the half cycle.

The time pattern graphs should display a monotonous sequence for both the half cycle and the full cycle times, with a small number of regular fluctuations. The sequence should be gradually less uniform when multiple threads are used.

The dependency of both the half cycle and the full cycle times on the number of threads should display constant minimum and median values and linearly increasing average and maximum values.

The client thruput should be constant, except on multiprocessor systems, where the thruput should increase initially until the number of threads reaches the number of processors.

The memory usage should be constant. The network usage should be zero. The thread usage should increase linearly on the client and be constant on the server. The processor usage should be monotonous and exclusively in user space.
**Orbix 5.1**

**Time Distribution (1 Thread)**
The graph depicts the statistical distribution of the time it takes to complete the empty cycle. On the X axis are the time intervals, on the Y axis is the percentage of empty cycles completed within the given time interval.

**Time Distribution (10 Threads)**
The graph depicts the statistical distribution of the time it takes to complete the empty cycle. On the X axis are the time intervals, on the Y axis is the percentage of empty cycles completed within the given time interval.

**Time Distribution (100 Threads)**
The graph depicts the statistical distribution of the time it takes to complete the empty cycle. On the X axis are the time intervals, on the Y axis is the percentage of empty cycles completed within the given time interval.

**Time Pattern (1 Thread)**
The graph depicts the pattern of changes of the time it takes to complete the empty cycle. On the X axis is the sequential number of the measurement, on the Y axis is the time it took to complete the cycle.
**Time Pattern (1 Thread, Zoom)**

The graph is a zoom in of the previous graph.

**Time Pattern (10 Threads)**

The graph depicts the pattern of changes of the time it takes to complete the empty cycle. On the X axis is the sequential number of the measurement, on the Y axis is the time it took to complete the cycle.
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Time Pattern (100 Threads, Zoom)
The graph is a zoom in of the previous graph.

Dependency On Number Of Threads
The graph depicts the dependency of the time it takes to complete the empty cycle on the number of threads running the cycle concurrently. On the X axis is the number of threads, on the Y axis is the time it took to complete the cycle.
TAO 1.2.4

Time Distribution (1 Thread)
The graph depicts the statistical distribution of the time it takes to complete the empty cycle. On the X axis are the time intervals, on the Y axis is the percentage of empty cycles completed within the given time interval.

Time Distribution (10 Threads)
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Time Pattern (10 Threads, Zoom)
The graph is a zoom in of the previous graph.

Time Pattern (100 Threads)
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Time Pattern (100 Threads, Zoom)
The graph is a zoom in of the previous graph.

Dependency On Number Of Threads
The graph depicts the dependency of the time it takes to complete the empty cycle on the number of threads running the cycle concurrently. On the X axis is the number of threads, on the Y axis is the time it took to complete the cycle.
VisiBroker 5.1

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**Time Pattern (1 Thread, Zoom)**
The graph is a zoom in of the previous graph.
Time Pattern (10 Threads)
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Time Pattern (10 Threads, Zoom)
The graph is a zoom in of the previous graph.

Time Pattern (100 Threads)
The graph depicts the pattern of changes of the time it takes to complete the empty cycle. On the X axis is the sequential number of the measurement, on the Y axis is the time it took to complete the cycle.

Time Pattern (100 Threads, Zoom)
The graph is a zoom in of the previous graph.

Dependency On Number Of Threads
The graph depicts the dependency of the time it takes to complete the empty cycle on the number of threads running the cycle concurrently. On the X axis is the number of threads, on the Y axis is the time it took to complete the cycle.
Summary

Time Distribution (1 Thread)
The graph depicts the statistical distribution of the time it takes to complete the empty cycle. On the X axis are the time intervals, on the Y axis is the percentage of empty cycles completed within the given time interval.

Time Distribution (10 Threads)
The graph depicts the statistical distribution of the time it takes to complete the empty cycle. On the X axis are the time intervals, on the Y axis is the percentage of empty cycles completed within the given time interval.

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Dependency On Number Of Threads
The graph depicts the dependency of the time it takes to complete the empty cycle on the number of threads running the cycle concurrently. On the X axis is the number of threads, on the Y axis is the time it took to complete the cycle.
Ping

Description
The suite measures the time it takes to complete a trivial method invocation. The purpose of the suite is to assess the behavior of the broker on as simple an example as possible to minimize the chance of a systematic error.

IDL Code
interface Ping { void Pong (); }

C++ Code
ulonglong ActionPing (void *pArgs)
{
pPing->Pong ();
return (0);
}

void PingServant::Pong ()
{
}

Java Code
public final void execute (long [] times) {
pingServer.Pong ();
}

public final void Pong ()
{
}

Results
The time distribution graphs should display a cluster with small variance. The observed times should correspond with the observed times of other suites. The time pattern graphs should display a sequence with small variance.
**Orbix 5.1**

**Time Distribution (1 Thread)**
The graph depicts the statistical distribution of the time it takes to complete the method invocation. On the X axis are the time intervals, on the Y axis is the percentage of invocations completed within the given time interval.

**Time Pattern (1 Thread)**
The graph depicts the pattern of changes of the time it takes to complete the method invocation. On the X axis is the sequential number of the measurement, on the Y axis is the time it took to complete the invocation.

**Time Pattern (1 Thread, Zoom)**
The graph is a zoom in of the previous graph.
Evaluation

The results exhibit no anomalies.
**TAO 1.2.4**

**Time Distribution (1 Thread)**
The graph depicts the statistical distribution of the time it takes to complete the method invocation. On the X axis are the time intervals, on the Y axis is the percentage of invocations completed within the given time interval.

![Time Distribution (1 Thread)](image)

**Time Pattern (1 Thread)**
The graph depicts the pattern of changes of the time it takes to complete the method invocation. On the X axis is the sequential number of the measurement, on the Y axis is the time it took to complete the invocation.

![Time Pattern (1 Thread)](image)

**Time Pattern (1 Thread, Zoom)**
The graph is a zoom in of the previous graph.
**Evaluation**

The results exhibit no anomalies.
**VisiBroker 5.1**

**Time Distribution (1 Thread)**
The graph depicts the statistical distribution of the time it takes to complete the method invocation. On the X axis are the time intervals, on the Y axis is the percentage of invocations completed within the given time interval.

![Time Distribution (1 Thread)](image)

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![Time Pattern (1 Thread)](image)

**Time Pattern (1 Thread, Zoom)**
The graph is a zoom in of the previous graph.
Evaluation

The results exhibit no anomalies.
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Time Distribution (1 Thread)
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Time Pattern (1 Thread)
The graph depicts the pattern of changes of the time it takes to complete the method invocation. On the X axis is the sequential number of the measurement, on the Y axis is the time it took to complete the invocation.

Evaluation
The results rate VisiBroker as the fastest broker in the scope measured by the suite, Orbix occupies the second and TAO the third place.
# Invocation

## Static Invocation

### Description

The suite measures the time it takes to complete a static method invocation. The purpose of the suite is to assess the behavior of the static invocation mechanism.

#### IDL Code

```idl
interface Ping { ulonglong Pong (); }
```

#### C++ Code

```cpp
ulonglong ActionPing (void *pArgs)
{
    return (pPing->Pong ());
}

CORBA::ULongLong PingServant::Pong ()
{
    return (TIMGetTimestamp ());
}
```

#### Java Code

```java
public final void execute (long [] times) {
    times [0] = pingServer.Pong ();
}

public final long Pong () {
    return SysInformer.timGetTimestamp ();
}
```

### Results

The time distribution graphs should display clusters with small variance for both the halfway and the roundtrip times. The clusters should be gradually wider when multiple threads are used.

The time pattern graphs should display a sequence with small variance for both the halfway and the roundtrip times. The sequence should be gradually less uniform when multiple threads are used.

The dependency of both the halfway and the roundtrip times on the number of threads should display constant minimum values and at least linearly increasing median, average and maximum values. The increase over the linear dependency represents the overhead introduced by the concurrent execution.

The client throughput should be constant or decreasing, except on multiprocessor systems, where the throughput should increase initially until the number of threads reaches the number of processors. The decrease under the constant level represents the overhead introduced by the concurrent execution.

The memory usage should be constant or very slightly increasing. The network usage should be constant or very slightly decreasing. The thread usage should grow linearly on the client and reflect the threading model on the server. The processor usage should follow the throughput.
**Orbix 5.1**

**Time Distribution (1 Thread)**
The graph depicts the statistical distribution of the time it takes to complete the method invocation. On the X axis are the time intervals, on the Y axis is the percentage of invocations completed within the given time interval.

![Time Distribution (1 Thread)](image)

**Time Distribution (10 Threads)**
The graph depicts the statistical distribution of the time it takes to complete the method invocation. On the X axis are the time intervals, on the Y axis is the percentage of invocations completed within the given time interval.

![Time Distribution (10 Threads)](image)

**Time Distribution (100 Threads)**
The graph depicts the statistical distribution of the time it takes to complete the method invocation. On the X axis are the time intervals, on the Y axis is the percentage of invocations completed within the given time interval.

![Time Distribution (100 Threads)](image)
**Time Pattern (1 Thread)**

The graph depicts the pattern of changes of the time it takes to complete the method invocation. On the X axis is the sequential number of the measurement, on the Y axis is the time it took to complete the invocation.

**Time Pattern (1 Thread, Zoom)**

The graph is a zoom in of the previous graph.
**Time Pattern (10 Threads)**

The graph depicts the pattern of changes of the time it takes to complete the method invocation. On the X axis is the sequential number of the measurement, on the Y axis is the time it took to complete the invocation.

**Time Pattern (10 Threads, Zoom)**

The graph is a zoom in of the previous graph.
**Time Pattern (100 Threads)**

The graph depicts the pattern of changes of the time it takes to complete the method invocation. On the X axis is the sequential number of the measurement, on the Y axis is the time it took to complete the invocation.

**Time Pattern (100 Threads, Zoom)**

The graph is a zoom in of the previous graph.
**Dependency On Number Of Threads**

The graph depicts the dependency of the time it takes to complete the invocation on the number of threads issuing the invocations concurrently. On the X axis is the number of threads, on the Y axis is the time it took to complete the invocation.
Evaluation

The roundtrip time for 1 thread corresponds with that of the Ping suite. The results indicate a slight decrease in throughput for a large number of threads.
**TAO 1.2.4**

**Time Distribution (1 Thread)**
The graph depicts the statistical distribution of the time it takes to complete the method invocation. On the X axis are the time intervals, on the Y axis is the percentage of invocations completed within the given time interval.

**Time Distribution (10 Threads)**
The graph depicts the statistical distribution of the time it takes to complete the method invocation. On the X axis are the time intervals, on the Y axis is the percentage of invocations completed within the given time interval.

**Time Distribution (100 Threads)**
The graph depicts the statistical distribution of the time it takes to complete the method invocation. On the X axis are the time intervals, on the Y axis is the percentage of invocations completed within the given time interval.
**Time Pattern (1 Thread)**

The graph depicts the pattern of changes of the time it takes to complete the method invocation. On the X axis is the sequential number of the measurement, on the Y axis is the time it took to complete the invocation.

**Time Pattern (1 Thread, Zoom)**

The graph is a zoom in of the previous graph.
Time Pattern (10 Threads)
The graph depicts the pattern of changes of the time it takes to complete the method invocation. On the X axis is the sequential number of the measurement, on the Y axis is the time it took to complete the invocation.

Time Pattern (10 Threads, Zoom)
The graph is a zoom in of the previous graph.
Time Pattern (100 Threads)

The graph depicts the pattern of changes of the time it takes to complete the method invocation. On the X axis is the sequential number of the measurement, on the Y axis is the time it took to complete the invocation.

Time Pattern (100 Threads, Zoom)

The graph is a zoom in of the previous graph.
Dependency On Number Of Threads

The graph depicts the dependency of the time it takes to complete the invocation on the number of threads issuing the invocations concurrently. On the X axis is the number of threads, on the Y axis is the time it took to complete the invocation.
Evaluation
The roundtrip time for 1 thread corresponds with that of the Ping suite. The results indicate a significant decrease in thruput for a large number of threads.
VisiBroker 5.1

Time Distribution (1 Thread)
The graph depicts the statistical distribution of the time it takes to complete the method invocation. On the X axis are the time intervals, on the Y axis is the percentage of invocations completed within the given time interval.

Time Distribution (10 Threads)
The graph depicts the statistical distribution of the time it takes to complete the method invocation. On the X axis are the time intervals, on the Y axis is the percentage of invocations completed within the given time interval.

Time Distribution (100 Threads)
The graph depicts the statistical distribution of the time it takes to complete the method invocation. On the X axis are the time intervals, on the Y axis is the percentage of invocations completed within the given time interval.
**Time Pattern (1 Thread)**

The graph depicts the pattern of changes of the time it takes to complete the method invocation. On the X axis is the sequential number of the measurement, on the Y axis is the time it took to complete the invocation.

**Time Pattern (1 Thread, Zoom)**

The graph is a zoom in of the previous graph.
Time Pattern (10 Threads)

The graph depicts the pattern of changes of the time it takes to complete the method invocation. On the X axis is the sequential number of the measurement, on the Y axis is the time it took to complete the invocation.

Time Pattern (10 Threads, Zoom)

The graph is a zoom in of the previous graph.
**Time Pattern (100 Threads)**

The graph depicts the pattern of changes of the time it takes to complete the method invocation. On the X axis is the sequential number of the measurement, on the Y axis is the time it took to complete the invocation.

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**Time Pattern (100 Threads, Zoom)**

The graph is a zoom in of the previous graph.
Dependency On Number Of Threads
The graph depicts the dependency of the time it takes to complete the invocation on the number of threads issuing the invocations concurrently. On the X axis is the number of threads, on the Y axis is the time it took to complete the invocation.
Evaluation

The roundtrip time for 1 thread corresponds with that of the Ping suite. The results indicate a significant increase in client memory usage for a large number of threads.
## Summary

### Time Distribution (1 Thread)

The graph depicts the statistical distribution of the time it takes to complete the method invocation. On the X axis are the time intervals, on the Y axis is the percentage of invocations completed within the given time interval.

![Time Distribution (1 Thread)](image1)

### Time Distribution (10 Threads)

The graph depicts the statistical distribution of the time it takes to complete the method invocation. On the X axis are the time intervals, on the Y axis is the percentage of invocations completed within the given time interval.

![Time Distribution (10 Threads)](image2)

### Time Distribution (100 Threads)

The graph depicts the statistical distribution of the time it takes to complete the method invocation. On the X axis are the time intervals, on the Y axis is the percentage of invocations completed within the given time interval.

![Time Distribution (100 Threads)](image3)
Time Pattern (1 Thread)
The graph depicts the pattern of changes of the time it takes to complete the method invocation. On the X axis is the sequential number of the measurement, on the Y axis is the time it took to complete the invocation.

Time Pattern (10 Threads)
The graph depicts the pattern of changes of the time it takes to complete the method invocation. On the X axis is the sequential number of the measurement, on the Y axis is the time it took to complete the invocation.
**Time Pattern (100 Threads)**

The graph depicts the pattern of changes of the time it takes to complete the method invocation. On the X axis is the sequential number of the measurement, on the Y axis is the time it took to complete the invocation.

**Dependency On Number Of Threads**

The graph depicts the dependency of the time it takes to complete the invocation on the number of threads issuing the invocations concurrently. On the X axis is the number of threads, on the Y axis is the time it took to complete the invocation.
Evaluation
The results rate VisiBroker as the fastest broker in the scope measured by the suite, Orbix occupies the second and TAO the third place. Orbix exhibits a slight decrease in throughput for a large number of threads. TAO exhibits a significant decrease in throughput for a large number of threads. VisiBroker exhibits a significant increase in client memory usage for a large number of threads.
Dynamic Invocation

Description
The suite measures the time it takes to complete a dynamic method invocation. The purpose of the suite is to assess the behavior of the dynamic invocation mechanism.

C++ Code

```cpp
ulonglong ActionPing (void *pArgs)
{
    CORBA::Request_var vRequest;
    CORBA::ULongLong iResult;

    vRequest = pPing->_request ("Pong");
    vRequest->set_return_type (CORBA::_tc_ulonglong);
    vRequest->invoke (ORBArgOnly);
    *(vRequest->result ()->value ()) >>= iResult;

    return (iResult);
}

void PingServant::invoke (CORBA::ServerRequest_ptr pRequest)
{
    if (!strcmp (pRequest->operation (), "Pong"))
    {
        // Note that calling arguments is mandated by the
        // standard even when the function has none.
        CORBA::NVList_ptr pArguments;
        CORBA::Any oResult;

        pORB->create_list (0, pArguments);
        pRequest->arguments (pArguments);
        oResult <<= (CORBA::ULongLong) TIMGetTimestamp ();
        pRequest->set_result (oResult);
    } else
    {
        assert (FALSE);
    }
}
```

Java Code

```java
public final void execute (long [] times)
{
    Request request = pingServer._request ("Pong");

    request.set_return_type (BenchBroker.theORB.get_primitive_tc (TCKind.tk_ulonglong));
    request.invoke ();

    times [0] = request.result ().value ().extract_ulonglong ();
}

public final void invoke (ServerRequest request)
{
    if (! request.operation ().equals ("Pong"))
    {
        throw new org.omg.CORBA.BAD_OPERATION ();
    }

    /*
    * Note that calling arguments is mandated by the
    * standard even when the function has none.
    */
    org.omg.CORBA.NVList args = BenchBroker.theORB.create_list (0);
    request.arguments (args);

    org.omg.CORBA.Any result = BenchBroker.theORB.create_any ();
    result.type (BenchBroker.theORB.get_primitive_tc (TCKind.tk_ulonglong));
    result.insert_ulonglong (SysInformer.timGetTimestamp ());
    request.set_result (result);
```
Results

The time distribution graphs should display clusters with small variance for both the halfway and the roundtrip times. The clusters should be gradually wider when multiple threads are used.

The time pattern graphs should display a sequence with small variance for both the halfway and the roundtrip times. The sequence should be gradually less uniform when multiple threads are used.

The dependency of both the halfway and the roundtrip times on the number of threads should display constant minimum values and at least linearly increasing median, average and maximum values. The increase over the linear dependency represents the overhead introduced by the concurrent execution.

The client throughput should be constant or decreasing, except on multiprocessor systems, where the throughput should increase initially until the number of threads reaches the number of processors. The decrease under the constant level represents the overhead introduced by the concurrent execution.

The memory usage should be constant or very slightly increasing. The network usage should be constant or very slightly decreasing. The thread usage should grow linearly on the client and reflect the threading model on the server. The processor usage should follow the throughput.
Orbix 5.1

Time Distribution (1 Thread)
The graph depicts the statistical distribution of the time it takes to complete the method invocation. On the X axis are the time intervals, on the Y axis is the percentage of invocations completed within the given time interval.

Time Distribution (10 Threads)
The graph depicts the statistical distribution of the time it takes to complete the method invocation. On the X axis are the time intervals, on the Y axis is the percentage of invocations completed within the given time interval.

Time Distribution (100 Threads)
The graph depicts the statistical distribution of the time it takes to complete the method invocation. On the X axis are the time intervals, on the Y axis is the percentage of invocations completed within the given time interval.
**Time Pattern (1 Thread)**

The graph depicts the pattern of changes of the time it takes to complete the method invocation. On the X axis is the sequential number of the measurement, on the Y axis is the time it took to complete the invocation.

**Time Pattern (1 Thread, Zoom)**

The graph is a zoom in of the previous graph.
Time Pattern (10 Threads)

The graph depicts the pattern of changes of the time it takes to complete the method invocation. On the X axis is the sequential number of the measurement, on the Y axis is the time it took to complete the invocation.

Time Pattern (10 Threads, Zoom)

The graph is a zoom in of the previous graph.
The graph depicts the pattern of changes of the time it takes to complete the method invocation. On the X axis is the sequential number of the measurement, on the Y axis is the time it took to complete the invocation.

The graph is a zoom in of the previous graph.
Dependency On Number Of Threads

The graph depicts the dependency of the time it takes to complete the invocation on the number of threads issuing the invocations concurrently. On the X axis is the number of threads, on the Y axis is the time it took to complete the invocation.
Evaluation

The roundtrip time for 1 thread is slightly higher than that of the Ping suite. The results indicate a significant decrease in throughput for a large number of threads.
**TAO 1.2.4**

**Time Distribution (1 Thread)**

The graph depicts the statistical distribution of the time it takes to complete the method invocation. On the X axis are the time intervals, on the Y axis is the percentage of invocations completed within the given time interval.

**Time Distribution (10 Threads)**

The graph depicts the statistical distribution of the time it takes to complete the method invocation. On the X axis are the time intervals, on the Y axis is the percentage of invocations completed within the given time interval.

**Time Distribution (100 Threads)**

The graph depicts the statistical distribution of the time it takes to complete the method invocation. On the X axis are the time intervals, on the Y axis is the percentage of invocations completed within the given time interval.
Time Pattern (1 Thread)

The graph depicts the pattern of changes of the time it takes to complete the method invocation. On the X axis is the sequential number of the measurement, on the Y axis is the time it took to complete the invocation.

Time Pattern (1 Thread, Zoom)

The graph is a zoom in of the previous graph.
Time Pattern (10 Threads)

The graph depicts the pattern of changes of the time it takes to complete the method invocation. On the X axis is the sequential number of the measurement, on the Y axis is the time it took to complete the invocation.

Time Pattern (10 Threads, Zoom)

The graph is a zoom in of the previous graph.
Time Pattern (100 Threads)
The graph depicts the pattern of changes of the time it takes to complete the method invocation. On the X axis is the sequential number of the measurement, on the Y axis is the time it took to complete the invocation.

Time Pattern (100 Threads, Zoom)
The graph is a zoom in of the previous graph.
Dependency On Number Of Threads

The graph depicts the dependency of the time it takes to complete the invocation on the number of threads issuing the invocations concurrently. On the X axis is the number of threads, on the Y axis is the time it took to complete the invocation.
Evaluation

The roundtrip time for 1 thread is slightly higher than that of the Ping suite. The results indicate a slight decrease in throughput for a large number of threads.
VisiBroker 5.1

Time Distribution (1 Thread)
The graph depicts the statistical distribution of the time it takes to complete the method invocation. On the X axis are the time intervals, on the Y axis is the percentage of invocations completed within the given time interval.

Time Distribution (10 Threads)
The graph depicts the statistical distribution of the time it takes to complete the method invocation. On the X axis are the time intervals, on the Y axis is the percentage of invocations completed within the given time interval.

Time Distribution (100 Threads)
The graph depicts the statistical distribution of the time it takes to complete the method invocation. On the X axis are the time intervals, on the Y axis is the percentage of invocations completed within the given time interval.
**Time Pattern (1 Thread)**

The graph depicts the pattern of changes of the time it takes to complete the method invocation. On the X axis is the sequential number of the measurement, on the Y axis is the time it took to complete the invocation.

**Time Pattern (1 Thread, Zoom)**

The graph is a zoom in of the previous graph.
**Time Pattern (10 Threads)**

The graph depicts the pattern of changes of the time it takes to complete the method invocation. On the X axis is the sequential number of the measurement, on the Y axis is the time it took to complete the invocation.

**Time Pattern (10 Threads, Zoom)**

The graph is a zoom in of the previous graph.
Time Pattern (100 Threads)

The graph depicts the pattern of changes of the time it takes to complete the method invocation. On the X axis is the sequential number of the measurement, on the Y axis is the time it took to complete the invocation.

Time Pattern (100 Threads, Zoom)

The graph is a zoom in of the previous graph.
**Dependency On Number Of Threads**

The graph depicts the dependency of the time it takes to complete the invocation on the number of threads issuing the invocations concurrently. On the X axis is the number of threads, on the Y axis is the time it took to complete the invocation.
Evaluation

The roundtrip time for 1 thread is slightly higher than that of the Ping suite. The results indicate a slight decrease in throughput for a large number of threads and a significant increase in client memory usage for a large number of threads.
Summary

Time Distribution (1 Thread)
The graph depicts the statistical distribution of the time it takes to complete the method invocation. On the X axis are the time intervals, on the Y axis is the percentage of invocations completed within the given time interval.

Time Distribution (10 Threads)
The graph depicts the statistical distribution of the time it takes to complete the method invocation. On the X axis are the time intervals, on the Y axis is the percentage of invocations completed within the given time interval.

Time Distribution (100 Threads)
The graph depicts the statistical distribution of the time it takes to complete the method invocation. On the X axis are the time intervals, on the Y axis is the percentage of invocations completed within the given time interval.
**Time Pattern (1 Thread)**

The graph depicts the pattern of changes of the time it takes to complete the method invocation. On the X axis is the sequential number of the measurement, on the Y axis is the time it took to complete the invocation.

**Time Pattern (10 Threads)**

The graph depicts the pattern of changes of the time it takes to complete the method invocation. On the X axis is the sequential number of the measurement, on the Y axis is the time it took to complete the invocation.
Time Pattern (100 Threads)

The graph depicts the pattern of changes of the time it takes to complete the method invocation. On the X axis is the sequential number of the measurement, on the Y axis is the time it took to complete the invocation.

Dependency On Number Of Threads

The graph depicts the dependency of the time it takes to complete the invocation on the number of threads issuing the invocations concurrently. On the X axis is the number of threads, on the Y axis is the time it took to complete the invocation.
Evaluation

The results rate VisiBroker as the fastest broker in the scope measured by the suite, Orbix occupies the second and TAO the third place. Orbix exhibits a significant decrease in throughput for a large number of threads. TAO exhibits a slight decrease in throughput for a large number of threads. VisiBroker exhibits a slight decrease in throughput and a significant increase in client memory usage for a large number of threads.
**Marshaling**

**Marshaling Basic Types**

**Description**
The suite measures the time it takes to complete a method invocation depending on the type and direction of the argument. The purpose of the suite is to assess the behavior of the marshaling mechanism.

**Direction IN**

**IDL Code**

typedef <type> tPingArg;
interface Ping { void Pong (in tPingArg xArg); }

**C++ Code**
tPingArg xPingArg;
ulonglong ActionPing (void *pArgs)
{
    pPing->Pong (xPingArg);
    return (0);
}
void PingServant::Pong (tPingArg xArg) { }

**Java Code**

private <type> pingArg;
public final void execute (long [] times) {
    pingServer.Pong (pingArg);
}

**Direction OUT**

**IDL Code**

typedef <type> tPingArg;
interface Ping { void Pong (out tPingArg xArg); }

**C++ Code**
tPingArg xPingArg;
ulonglong ActionPing (void *pArgs)
{
    pPing->Pong (xPingArg);
    return (0);
}
void PingServant::Pong (tPingArg_out xArg) { }

**Java Code**

private <type> pingArg;
public final void execute (long [] times) {
    pingServer.Pong (pingArg);
}

**Direction INOUT**

**IDL Code**

typedef <type> tPingArg;
interface Ping { void Pong (inout tPingArg xArg); }

**C++ Code**

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tPingArg xPingArg;
ulonglong ActionPing (void *pArgs)
{
    pPing->Pong (xPingArg);
    return (0);
}

void PingServant::Pong (tPingArg &xArg) { }

Java Code

private <type> pingArg;
public final void execute (long [] times) {
    pingServer.Pong (pingArg);
}

public final void Pong (<type> xArg) { }

Direction RETURN

IDL Code

typedef <type> tPingArg;
interface Ping { tPingArg Pong (); }  

C++ Code

ulonglong ActionPing (void *pArgs)
{
    pPing->Pong ();
    return (0);
}

tPingArg xPingArg;
tPingArg PingServant::Pong ()
{
    return (xPingArg);
}

Java Code

public final void execute (long [] times) {
    pingServer.Pong ();
}

private <type> pingArg;
public final <type> Pong () {
    return (pingArg);
}

Results

The roundtrip time should be constant for all the types and directions of the argument, except for the char and wchar types, where the roundtrip time may be affected by the character set conversion, and the long long, unsigned long long and long double types, where the roundtrip time may be affected by the handling of non native types. The quartile range of the values should be small.

The memory usage, network usage and processor usage should be constant, except for the char and wchar types, where the usage may be affected by the character set conversion, and the long long, unsigned long long and long double types, where the usage may be affected by the handling of non native types.
Dependency On Type (Direction IN, 1 Thread)

The graph depicts the dependency of the time it takes to complete the invocation on the type and direction of the argument. On the X axis is the type of the argument, on the Y axis is the time it took to complete the invocation.
Dependency On Type (Direction OUT, 1 Thread)

The graph depicts the dependency of the time it takes to complete the invocation on the type and direction of the argument. On the X axis is the type of the argument, on the Y axis is the time it took to complete the invocation.
Dependency On Type (Direction INOUT, 1 Thread)
The graph depicts the dependency of the time it takes to complete the invocation on the type and direction of the argument. On the X axis is the type of the argument, on the Y axis is the time it took to complete the invocation.
Dependency On Type (Direction RETURN, 1 Thread)

The graph depicts the dependency of the time it takes to complete the invocation on the type and direction of the argument. On the X axis is the type of the argument, on the Y axis is the time it took to complete the invocation.
Notes

The broker does not support the long double type.

Evaluation

The roundtrip times correspond with that of the Ping suite. The results exhibit no anomalies.
TAO 1.2.4

Dependency On Type (Direction IN, 1 Thread)

The graph depicts the dependency of the time it takes to complete the invocation on the type and direction of the argument. On the X axis is the type of the argument, on the Y axis is the time it took to complete the invocation.
Dependency On Type (Direction OUT, 1 Thread)

The graph depicts the dependency of the time it takes to complete the invocation on the type and direction of the argument. On the X axis is the type of the argument, on the Y axis is the time it took to complete the invocation.
Dependency On Type (Direction INOUT, 1 Thread)

The graph depicts the dependency of the time it takes to complete the invocation on the type and direction of the argument. On the X axis is the type of the argument, on the Y axis is the time it took to complete the invocation.
Dependency On Type (Direction RETURN, 1 Thread)

The graph depicts the dependency of the time it takes to complete the invocation on the type and direction of the argument. On the X axis is the type of the argument, on the Y axis is the time it took to complete the invocation.
Evaluation
The roundtrip times correspond with that of the Ping suite. The results exhibit no anomalies.
VisiBroker 5.1

Dependency On Type (Direction IN, 1 Thread)

The graph depicts the dependency of the time it takes to complete the invocation on the type and direction of the argument. On the X axis is the type of the argument, on the Y axis is the time it took to complete the invocation.
Dependency On Type (Direction OUT, 1 Thread)

The graph depicts the dependency of the time it takes to complete the invocation on the type and direction of the argument. On the X axis is the type of the argument, on the Y axis is the time it took to complete the invocation.
Dependency On Type (Direction INOUT, 1 Thread)

The graph depicts the dependency of the time it takes to complete the invocation on the type and direction of the argument. On the X axis is the type of the argument, on the Y axis is the time it took to complete the invocation.
Dependency On Type (Direction RETURN, 1 Thread)

The graph depicts the dependency of the time it takes to complete the invocation on the type and direction of the argument. On the X axis is the type of the argument, on the Y axis is the time it took to complete the invocation.
Notes
The broker does not support the `long double` type.

Evaluation
The roundtrip times correspond with that of the Ping suite. The results exhibit no anomalies.
Summary

Dependency On Type (Direction IN, 1 Thread)

The graph depicts the dependency of the time it takes to complete the invocation on the type and direction of the argument. On the X axis is the type of the argument, on the Y axis is the time it took to complete the invocation.
Dependency On Type (Direction OUT, 1 Thread)

The graph depicts the dependency of the time it takes to complete the invocation on the type and direction of the argument. On the X axis is the type of the argument, on the Y axis is the time it took to complete the invocation.
Dependency On Type (Direction INOUT, 1 Thread)

The graph depicts the dependency of the time it takes to complete the invocation on the type and direction of the argument. On the X axis is the type of the argument, on the Y axis is the time it took to complete the invocation.
Dependency On Type (Direction RETURN, 1 Thread)

The graph depicts the dependency of the time it takes to complete the invocation on the type and direction of the argument. On the X axis is the type of the argument, on the Y axis is the time it took to complete the invocation.
Notes

Orbix and VisiBroker do not support the `long double` type.

Evaluation

The results rate VisiBroker as the fastest broker in the scope measured by the suite, Orbix occupies the second and TAO the third place.
Marshaling Arrays Of Basic Types

Description
The suite measures the time it takes to complete a method invocation depending on the type and direction of the argument. The purpose of the suite is to assess the behavior of the marshaling mechanism.

Direction IN

IDL Code

typedef <type> tPingArg [size];
interface Ping { void Pong (in tPingArg xArg); }

C++ Code

tPingArg xPingArg;
ulonglong ActionPing (void *pArgs)
{
    pPing->Pong (xPingArg);
    return (0);
}

void PingServant::Pong (const tPingArg xArg) { }

Java Code

private tPingArgHolder pingArg;
public final void execute (long [] times) {
    pingServer.Pong (pingArg.value);
}

public final void Pong (<type> [] xArg) { }

Direction OUT

IDL Code

typedef <type> tPingArg [size];
interface Ping { void Pong (out tPingArg xArg); }

C++ Code

tPingArg xPingArg;
ulonglong ActionPing (void *pArgs)
{
    pPing->Pong (xPingArg);
    return (0);
}

void PingServant::Pong (tPingArg_out xArg) { }

Java Code

private tPingArgHolder pingArg;
public final void execute (long [] times) {
    pingServer.Pong (pingArg.value);
    pingArg.value = null;
}

private <type> [] pingArg = new <type> [size];
public final void Pong (tPingArgHolder xArg) {
    xArg.value = pingArg;
}

Direction INOUT

IDL Code

typedef <type> tPingArg [size];
interface Ping { void Pong (inout tPingArg xArg); }

C++ Code

tPingArg xPingArg;
ulonglong ActionPing (void *pArgs)
{
    pPing->Pong (xPingArg);
    return (0);
}

void PingServant::Pong (tPingArg &xArg) { }

Java Code

private tPingArgHolder pingArg;
public final void execute (long [] times) {
    pingServer.Pong (pingArg);
}

public final void Pong (tPingArgHolder xArg) { }

Direction RETURN

IDL Code

typedef <type> tPingArg [<size>];
interface Ping { tPingArg Pong (); }
Orbix 5.1

Dependency On Type (Direction IN, 1024 Octets, 1 Thread)

The graph depicts the dependency of the time it takes to complete the invocation on the type and direction of the argument. On the X axis is the type of the argument, on the Y axis is the time it took to complete the invocation.
**Dependency On Type (Direction OUT, 1024 Octets, 1 Thread)**

The graph depicts the dependency of the time it takes to complete the invocation on the type and direction of the argument. On the X axis is the type of the argument, on the Y axis is the time it took to complete the invocation.
Dependency On Type (Direction INOUT, 1024 Octets, 1 Thread)

The graph depicts the dependency of the time it takes to complete the invocation on the type and direction of the argument. On the X axis is the type of the argument, on the Y axis is the time it took to complete the invocation.
Dependency On Type (Direction RETURN, 1024 Octets, 1 Thread)

The graph depicts the dependency of the time it takes to complete the invocation on the type and direction of the argument. On the X axis is the type of the argument, on the Y axis is the time it took to complete the invocation.
Dependency On Type (Direction IN, 1024 Items, 1 Thread)

The graph depicts the dependency of the time it takes to complete the invocation on the type and direction of the argument. On the X axis is the type of the argument, on the Y axis is the time it took to complete the invocation.
Dependency On Type (Direction OUT, 1024 Items, 1 Thread)

The graph depicts the dependency of the time it takes to complete the invocation on the type and direction of the argument. On the X axis is the type of the argument, on the Y axis is the time it took to complete the invocation.
Dependency On Type (Direction INOUT, 1024 Items, 1 Thread)

The graph depicts the dependency of the time it takes to complete the invocation on the type and direction of the argument. On the X axis is the type of the argument, on the Y axis is the time it took to complete the invocation.
Dependency On Type (Direction RETURN, 1024 Items, 1 Thread)

The graph depicts the dependency of the time it takes to complete the invocation on the type and direction of the argument. On the X axis is the type of the argument, on the Y axis is the time it took to complete the invocation.
Notes
The broker does not support the long double type.

Evaluation
The results indicate a significant overhead of the character set conversion for the wchar type.
Dependency On Type (Direction IN, 1024 Octets, 1 Thread)

The graph depicts the dependency of the time it takes to complete the invocation on the type and direction of the argument. On the X axis is the type of the argument, on the Y axis is the time it took to complete the invocation.

- **Roundtrip Time**
- **Server Memory**
- **Client Network Bytes**
- **Client Network Packets**
Dependency On Type (Direction OUT, 1024 Octets, 1 Thread)

The graph depicts the dependency of the time it takes to complete the invocation on the type and direction of the argument. On the X axis is the type of the argument, on the Y axis is the time it took to complete the invocation.
Dependency On Type (Direction INOUT, 1024 Octets, 1 Thread)

The graph depicts the dependency of the time it takes to complete the invocation on the type and direction of the argument. On the X axis is the type of the argument, on the Y axis is the time it took to complete the invocation.
Dependency On Type (Direction RETURN, 1024 Octets, 1 Thread)

The graph depicts the dependency of the time it takes to complete the invocation on the type and direction of the argument. On the X axis is the type of the argument, on the Y axis is the time it took to complete the invocation.
Dependency On Type (Direction IN, 1024 Items, 1 Thread)

The graph depicts the dependency of the time it takes to complete the invocation on the type and direction of the argument. On the X axis is the type of the argument, on the Y axis is the time it took to complete the invocation.
Dependency On Type (Direction OUT, 1024 Items, 1 Thread)

The graph depicts the dependency of the time it takes to complete the invocation on the type and direction of the argument. On the X axis is the type of the argument, on the Y axis is the time it took to complete the invocation.
Dependency On Type (Direction INOUT, 1024 Items, 1 Thread)

The graph depicts the dependency of the time it takes to complete the invocation on the type and direction of the argument. On the X axis is the type of the argument, on the Y axis is the time it took to complete the invocation.
Dependency On Type (Direction RETURN, 1024 Items, 1 Thread)

The graph depicts the dependency of the time it takes to complete the invocation on the type and direction of the argument. On the X axis is the type of the argument, on the Y axis is the time it took to complete the invocation.
Evaluation

The results exhibit no anomalies.
VisiBroker 5.1

Dependency On Type (Direction IN, 1024 Octets, 1 Thread)
The graph depicts the dependency of the time it takes to complete the invocation on the type and direction of the argument. On the X axis is the type of the argument, on the Y axis is the time it took to complete the invocation.
Dependency On Type (Direction OUT, 1024 Octets, 1 Thread)

The graph depicts the dependency of the time it takes to complete the invocation on the type and direction of the argument. On the X axis is the type of the argument, on the Y axis is the time it took to complete the invocation.
Dependency On Type (Direction INOUT, 1024 Octets, 1 Thread)

The graph depicts the dependency of the time it takes to complete the invocation on the type and direction of the argument. On the X axis is the type of the argument, on the Y axis is the time it took to complete the invocation.
Dependency On Type (Direction RETURN, 1024 Octets, 1 Thread)

The graph depicts the dependency of the time it takes to complete the invocation on the type and direction of the argument. On the X axis is the type of the argument, on the Y axis is the time it took to complete the invocation.
Dependency On Type (Direction IN, 1024 Items, 1 Thread)

The graph depicts the dependency of the time it takes to complete the invocation on the type and direction of the argument. On the X axis is the type of the argument, on the Y axis is the time it took to complete the invocation.
Dependency On Type (Direction OUT, 1024 Items, 1 Thread)

The graph depicts the dependency of the time it takes to complete the invocation on the type and direction of the argument. On the X axis is the type of the argument, on the Y axis is the time it took to complete the invocation.
Dependency On Type (Direction INOUT, 1024 Items, 1 Thread)

The graph depicts the dependency of the time it takes to complete the invocation on the type and direction of the argument. On the X axis is the type of the argument, on the Y axis is the time it took to complete the invocation.
Dependency On Type (Direction RETURN, 1024 Items, 1 Thread)

The graph depicts the dependency of the time it takes to complete the invocation on the type and direction of the argument. On the X axis is the type of the argument, on the Y axis is the time it took to complete the invocation.
Notes
The broker does not support the `long double` type.

Evaluation
The results indicate a significant overhead of the character set conversion for the `wchar` type.
Summary

Dependency On Type (Direction IN, 1024 Octets, 1 Thread)

The graph depicts the dependency of the time it takes to complete the invocation on the type and direction of the argument. On the X axis is the type of the argument, on the Y axis is the time it took to complete the invocation.
Dependency On Type (Direction OUT, 1024 Octets, 1 Thread)
The graph depicts the dependency of the time it takes to complete the invocation on the type and direction of the argument. On the X axis is the type of the argument, on the Y axis is the time it took to complete the invocation.
**Dependency On Type (Direction INOUT, 1024 Octets, 1 Thread)**

The graph depicts the dependency of the time it takes to complete the invocation on the type and direction of the argument. On the X axis is the type of the argument, on the Y axis is the time it took to complete the invocation.
Dependency On Type (Direction RETURN, 1024 Octets, 1 Thread)

The graph depicts the dependency of the time it takes to complete the invocation on the type and direction of the argument. On the X axis is the type of the argument, on the Y axis is the time it took to complete the invocation.
Dependency On Type (Direction IN, 1024 Items, 1 Thread)

The graph depicts the dependency of the time it takes to complete the invocation on the type and direction of the argument. On the X axis is the type of the argument, on the Y axis is the time it took to complete the invocation.
Dependency On Type (Direction OUT, 1024 Items, 1 Thread)

The graph depicts the dependency of the time it takes to complete the invocation on the type and direction of the argument. On the X axis is the type of the argument, on the Y axis is the time it took to complete the invocation.
Dependency On Type (Direction INOUT, 1024 Items, 1 Thread)
The graph depicts the dependency of the time it takes to complete the invocation on the type and direction of the argument. On the X axis is the type of the argument, on the Y axis is the time it took to complete the invocation.
Dependency On Type (Direction RETURN, 1024 Items, 1 Thread)

The graph depicts the dependency of the time it takes to complete the invocation on the type and direction of the argument. On the X axis is the type of the argument, on the Y axis is the time it took to complete the invocation.
**Notes**

Orbix and VisiBroker do not support the `long double` type.

**Evaluation**

The results rate VisiBroker as the fastest broker in the scope measured by the suite, Orbix occupies the second and TAO the third place. Orbix exhibits a significant overhead of the character set conversion for the `wchar` type. VisiBroker exhibits a significant overhead of the character set conversion for the `wchar` type.
Marshaling Sequences Of Octets

Description
The suite measures the time it takes to complete a method invocation depending on the size of the octet sequence passed as argument. The purpose of the suite is to assess the behavior of the marshaling mechanism.

Direction IN

IDL Code

typedef sequence<octet> tOctetSequence;
interface Ping { void Pong (in tOctetSequence sSequence); }

C++ Code

tOctetSequence *pPingOctetSequence;
ulonglong ActionPing (void *pArgs)
{
    pPing->Pong (*pPingOctetSequence);
}

void PingServant::Pong (const tOctetSequence &sSequence) { }

Java Code

private tOctetSequenceHolder sequenceHolder;

public final void execute (long [] times) {
    pingServer.Pong (sequenceHolder.value);
}

public final void Pong (byte [] sSequence) { }

Direction OUT

IDL Code

typedef sequence<octet> tOctetSequence;
interface Ping{
    void Pong (in unsigned long iLength, out tOctetSequence sSequence);
}

C++ Code

tOctetSequence *pPingOctetSequence;
CORBA::ULong iPingOctetSequenceLength;
ulonglong ActionPing (void *pArgs)
{
    pPing->Pong (iPingOctetSequenceLength, pPingOctetSequence);
    delete (pPingOctetSequence);
}

void PingServant::Pong (CORBA::ULong iLength, tOctetSequence_out pSequence)
{
    pSequence = new tOctetSequence (iLength);
    pSequence->length (iLength);
}

Java Code

public static int sequenceLength;
private tOctetSequenceHolder sequenceHolder;

public final void execute (long [] times) {
    pingServer.Pong (sequenceLength, sequenceHolder);
    sequenceHolder.value = null;
}

public final void Pong (int iLength, tOctetSequenceHolder sSequence) {
    sSequence.value = new byte [iLength];
}
**Direction INOUT**

**IDL Code**

typedef sequence<octet> tOctetSequence;
interface Ping { void Pong (inout tOctetSequence sSequence); }  

**C++ Code**

tOctetSequence *pPingOctetSequence;
ulonglong ActionPing (void *pArgs)
{
    pPing->Pong (*pPingOctetSequence);
}
void PingServant::Pong (tOctetSequence &sSequence) { }

**Java Code**

private tOctetSequenceHolder sequenceHolder;
public final void execute (long [] times) {
    pingServer.Pong (sequenceHolder);
}

public final void Pong (tOctetSequenceHolder sSequence) { }

**Direction RETURN**

**IDL Code**

typedef sequence<octet> tOctetSequence;
interface Ping { tOctetSequence Pong (in unsigned long iLength); }  

**C++ Code**

CORBA::ULong iPingOctetSequenceLength;
ulonglong ActionPing (void *pArgs)
{
    delete (pPing->Pong (iPingOctetSequenceLength);
}
tOctetSequence *PingServant::Pong (CORBA::ULong iLength)
{
    tOctetSequence *pSequence;
    pSequence = new tOctetSequence (iLength);
    pSequence->length (iLength);
    return (pSequence);
}

**Java Code**

public static int sequenceLength;
public final void execute (long [] times) {
    pingServer.Pong (sequenceLength);
}

public final byte [] Pong (int iLength) {
    return new byte [iLength];
}

**Results**
The dependency of the roundtrip time on the size of the sequence should display linearly increasing minimum, median and average values and reasonably small maximum values.
The memory usage should be constant or very slightly increasing. The network usage should be asymptotically increasing towards the maximum capacity. The processor usage should follow the network usage.
Orbix 5.1

Dependency On Size Of Sequence (Direction IN, 1 Thread)

The graph depicts the dependency of the time it takes to complete the invocation on the size of the octet sequence passed as argument. On the X axis is the size of the sequence, on the Y axis is the time it took to complete the invocation.
Dependency On Size Of Sequence (Direction OUT, 1 Thread)
The graph depicts the dependency of the time it takes to complete the invocation on the size of the octet sequence passed as argument. On the X axis is the size of the sequence, on the Y axis is the time it took to complete the invocation.

![Graphs showing dependency on size of sequence](image-url)
Dependency On Size Of Sequence (Direction INOUT, 1 Thread)

The graph depicts the dependency of the time it takes to complete the invocation on the size of the octet sequence passed as argument. On the X axis is the size of the sequence, on the Y axis is the time it took to complete the invocation.
Dependency On Size Of Sequence (Direction RETURN, 1 Thread)

The graph depicts the dependency of the time it takes to complete the invocation on the size of the octet sequence passed as argument. On the X axis is the size of the sequence, on the Y axis is the time it took to complete the invocation.
Evaluation

The roundtrip time for 1 octet sequence corresponds with that of the Ping suite. The results exhibit no anomalies.
TAO 1.2.4

Dependency On Size Of Sequence (Direction IN, 1 Thread)
The graph depicts the dependency of the time it takes to complete the invocation on the size of the octet sequence passed as argument. On the X axis is the size of the sequence, on the Y axis is the time it took to complete the invocation.
Dependency On Size Of Sequence (Direction OUT, 1 Thread)

The graph depicts the dependency of the time it takes to complete the invocation on the size of the octet sequence passed as argument. On the X axis is the size of the sequence, on the Y axis is the time it took to complete the invocation.
Dependency On Size Of Sequence (Direction INOUT, 1 Thread)

The graph depicts the dependency of the time it takes to complete the invocation on the size of the octet sequence passed as argument. On the X axis is the size of the sequence, on the Y axis is the time it took to complete the invocation.
Dependency On Size Of Sequence (Direction RETURN, 1 Thread)

The graph depicts the dependency of the time it takes to complete the invocation on the size of the octet sequence passed as argument. On the X axis is the size of the sequence, on the Y axis is the time it took to complete the invocation.
Evaluation

The roundtrip time for 1 octet sequence corresponds with that of the Ping suite. The results exhibit no anomalies.
**VisiBroker 5.1**

**Dependency On Size Of Sequence (Direction IN, 1 Thread)**

The graph depicts the dependency of the time it takes to complete the invocation on the size of the octet sequence passed as argument. On the X axis is the size of the sequence, on the Y axis is the time it took to complete the invocation.
Dependency On Size Of Sequence (Direction OUT, 1 Thread)

The graph depicts the dependency of the time it takes to complete the invocation on the size of the octet sequence passed as argument. On the X axis is the size of the sequence, on the Y axis is the time it took to complete the invocation.
Dependency On Size Of Sequence (Direction INOUT, 1 Thread)

The graph depicts the dependency of the time it takes to complete the invocation on the size of the octet sequence passed as argument. On the X axis is the size of the sequence, on the Y axis is the time it took to complete the invocation.
Dependency On Size Of Sequence (Direction RETURN, 1 Thread)

The graph depicts the dependency of the time it takes to complete the invocation on the size of the octet sequence passed as argument. On the X axis is the size of the sequence, on the Y axis is the time it took to complete the invocation.
Evaluation

The roundtrip time for 1 octet sequence corresponds with that of the Ping suite. The results exhibit no anomalies.
Summary

Dependency On Size Of Sequence (Direction IN, 1 Thread)
The graph depicts the dependency of the time it takes to complete the invocation on the size of the octet sequence passed as argument. On the X axis is the size of the sequence, on the Y axis is the time it took to complete the invocation.
Dependency On Size Of Sequence (Direction OUT, 1 Thread)

The graph depicts the dependency of the time it takes to complete the invocation on the size of the octet sequence passed as argument. On the X axis is the size of the sequence, on the Y axis is the time it took to complete the invocation.
Dependency On Size Of Sequence (Direction INOUT, 1 Thread)

The graph depicts the dependency of the time it takes to complete the invocation on the size of the octet sequence passed as argument. On the X axis is the size of the sequence, on the Y axis is the time it took to complete the invocation.
Dependency On Size Of Sequence (Direction RETURN, 1 Thread)

The graph depicts the dependency of the time it takes to complete the invocation on the size of the octet sequence passed as argument. On the X axis is the size of the sequence, on the Y axis is the time it took to complete the invocation.
Evaluation

The results rate Orbix, TAO and VisiBroker as of the same speed in the scope measured by the suite. Orbix, TAO and VisiBroker exhibit the same shape of dependency on the size of sequence.
**Dispatching**

**Dispatching To Servant Instances**

**Description**

The suite measures the time it takes to complete a method invocation depending on the number of active servants hosted by the server. The purpose of the suite is to assess the behavior of the dispatching mechanism.

**IDL Code**

```idl
interface Ping { void Pong (); }
typedef sequence<Ping> tPingSequence;
```

**C++ Code**

```c++
tPingSequence *pPingSequence;
CORBA::ULong iPingSequenceLength;
ulonglong ActionPing (void *pArgs)
{
    (*pPingSequence) [RNDGetRandom (iPingSequenceLength)]->Pong ();
    return (0);
}
void PingServant::Pong () { }
```

**Java Code**

```java
public static int pingSequenceLength;
public static Ping [] pingSequence;
public final void execute (long [] times) {
    pingSequence [(int) BenchGlobal.rand (pingSequenceLength)].Pong ();
}
public final void Pong () { }
```

**Results**

The dependency of the roundtrip time on the number of servants should display constant or less than linearly increasing minimum, median and average values and reasonably small maximum values.

The memory usage should be linearly increasing and reflect the size of the servants on the server and the proxies on the client. The network usage should be constant or very slightly decreasing. The processor usage should be monotonous.
Orbix 5.1

Dependency On Number Of Servants (1 Thread)
The graph depicts the dependency of the time it takes to complete the invocation on the number of active servants hosted by the server. On the X axis is the number of servants, on the Y axis is the time it took to complete the invocation.
Dependency On Number Of Servants (1 Thread, Zoom)

The graph is a zoom in of the previous graph.
Evaluation
The roundtrip time for 1 servant instance corresponds with that of the Ping suite. The results indicate a slight increase in the invocation time for a large number of servants. The memory usage observed during the test is roughly 330 bytes per servant instance on the server and roughly 450 bytes per proxy instance on the client.
TAO 1.2.4

Dependency On Number Of Servants (1 Thread)

The graph depicts the dependency of the time it takes to complete the invocation on the number of active servants hosted by the server. On the X axis is the number of servants, on the Y axis is the time it took to complete the invocation.
Dependency On Number Of Servants (1 Thread, Zoom)

The graph is a zoom in of the previous graph.
Evaluation
The roundtrip time for 1 servant instance corresponds with that of the Ping suite. The results exhibit no anomalies. The memory usage observed during the test is roughly 1300 bytes per servant instance on the server and roughly 1400 bytes per proxy instance on the client.
VisiBroker 5.1

Dependency On Number Of Servants (1 Thread)

The graph depicts the dependency of the time it takes to complete the invocation on the number of active servants hosted by the server. On the X axis is the number of servants, on the Y axis is the time it took to complete the invocation.
Dependency On Number Of Servants (1 Thread, Zoom)

The graph is a zoom in of the previous graph.
Evaluation

The roundtrip time for 1 servant instance corresponds with that of the Ping suite. The results indicate a significant increase in the invocation time for a large number of servants. The memory usage observed during the test is roughly 2400 bytes per servant instance on the server and roughly 5000 bytes per proxy instance on the client.
Summary

Dependency On Number Of Servants (1 Thread)

The graph depicts the dependency of the time it takes to complete the invocation on the number of active servants hosted by the server. On the X axis is the number of servants, on the Y axis is the time it took to complete the invocation.

![Graph of Dependency On Number Of Servants (1 Thread)](image)

- **Graph Title:** Dependency On Number Of Servants (1 Thread)
- **X Axis:** Number of Servants
- **Y Axis:** Time to Complete Invocation
Dependency On Number Of Servants (1 Thread, Zoom)

The graph is a zoom in of the previous graph.
Evaluation

The results rate Orbix as the fastest broker in the scope measured by the suite, TAO occupies the second and VisiBroker the third place. For a small number of objects, VisiBroker rates as the fastest broker, Orbix occupies the second and TAO the third place. Orbix and TAO exhibit the best shape of dependency on the number of servants, VisiBroker occupies the second place. Orbix exhibits the smallest memory usage, TAO occupies the second and VisiBroker the third place.
Lifecycle Of Servant Instances

Description
The suite measures the time it takes to create and delete a servant and to create and delete a proxy depending on the number of active servants hosted by the server and active proxies hosted by the client. The purpose of the suite is to assess the behavior of the servant lifecycle mechanism.

IDL Code

```idl
interface Empty { }
typedef sequence<Empty> tEmptySequence;
interface EmptyFactory
{
    void CreateIndividual (out Empty oEmpty,
                            out unsigned long long iTimeInvoke,
                            out unsigned long long iTimeReturn);
    void DeleteIndividual (in Empty oEmpty,
                           out unsigned long long iTimeInvoke,
                           out unsigned long long iTimeReturn);
    tEmptySequence CreateSequence (in unsigned long iLength);
};
```

C++ Code

```cpp
tEmptyFactory *pEmptyFactory;
void ActionCreateDelete (tMEAArgs *pArgs)
{
    Empty_ptr pEmpty;
pEmptyFactory->createIndividual (pEmpty,
                                    pArgs->aiTimes [BEN_StampCreateInvoke],
                                    pArgs->aiTimes [BEN_StampCreateReturn]);
pArgs->aiTimes [BEN_StampCreateFinish] = TIMGetTimestamp ();
pEmptyFactory->deleteIndividual (pEmpty,
                                    pArgs->aiTimes [BEN_StampDeleteInvoke],
                                    pArgs->aiTimes [BEN_StampDeleteReturn]);
CORBA::release (pEmpty);
pArgs->aiTimes [BEN_StampDeleteFinish] = TIMGetTimestamp ();
}
```

Java Code

```java
public static int emptySequenceLength;
public static Empty [] emptySequence;
public static EmptyFactory emptyFactory;
private LongHolder invokeStamp = new LongHolder ();
private LongHolder returnStamp = new LongHolder ();
private EmptyHolder emptyHolder = new EmptyHolder ();
public final void execute (long [] times) {
```
emptyFactory.CreateIndividual (emptyHolder, invokeStamp, returnStamp);
times [BEN_StampCreateFinish] = SysInformer.timGetTimestamp ();
times [BEN_StampCreateInvoke] = invokeStamp.value;
times [BEN_StampCreateReturn] = returnStamp.value;

emptyFactory.DeleteIndividual (emptyHolder.value, invokeStamp, returnStamp);
times [BEN_StampDeleteFinish] = SysInformer.timGetTimestamp ();
times [BEN_StampDeleteInvoke] = invokeStamp.value;
times [BEN_StampDeleteReturn] = returnStamp.value;

emptyHolder.value = null;
}

public final void CreateIndividual {
    EmptyHolder oEmpty, LongHolder iTimeInvoke, LongHolder iTimeReturn) {
        iTimeInvoke.value = SysInformer.timGetTimestamp ();
        EmptyServant emptyServant = new EmptyServant ();
        oEmpty.value = EmptyHelper.narrow (BenchBroker.rootPOA.servant_to_reference (emptyServant));
        iTimeReturn.value = SysInformer.timGetTimestamp ();
    }

public final void DeleteIndividual {
    Empty oEmpty, LongHolder iTimeInvoke, LongHolder iTimeReturn) {
        iTimeInvoke.value = SysInformer.timGetTimestamp ();
        byte [] emptyOID = BenchBroker.rootPOA.reference_to_id (oEmpty);
        BenchBroker.rootPOA.deactivate_object (emptyOID);
        iTimeReturn.value = SysInformer.timGetTimestamp ();
    }

Results

The dependency of the create and the delete times on the number of servants should display constant or less than linearly increasing minimum, median and average values and reasonably small maximum values.

The memory usage should be linearly increasing and reflect the size of the servants on the server and the proxies on the client. The network usage should be constant or very slightly decreasing. The processor usage should be monotonous.
Orbix 5.1

Dependency Of Create On Number Of Servants (1 Thread)

The graph depicts the dependency of the time it takes to create a servant on the number of active servants hosted by the server and the number of active proxies hosted by the client. On the X axis is the number of servants and proxies, on the Y axis is the time it took to create the servant.
Dependency Of Create On Number Of Servants (1 Thread, Zoom)

The graph depicts the dependency of the time it takes to create a servant on the number of active servants hosted by the server and the number of active proxies hosted by the client. On the X axis is the number of servants and proxies, on the Y axis is the time it took to create the servant.
Dependency Of Delete On Number Of Servants (1 Thread)

The graph depicts the dependency of the time it takes to delete a servant on the number of active servants hosted by the server and the number of active proxies hosted by the client. On the X axis is the number of servants and proxies, on the Y axis is the time it took to delete the servant.
Dependency Of Delete On Number Of Servants (1 Thread, Zoom)

The graph depicts the dependency of the time it takes to delete a servant on the number of active servants hosted by the server and the number of active proxies hosted by the client. On the X axis is the number of servants and proxies, on the Y axis is the time it took to delete the servant.
Evaluation

The results indicate a significant increase in the create and delete times for a large number of servants. The memory usage observed during the test is roughly 330 bytes per servant instance on the server and roughly 430 bytes per proxy instance on the client.
TAO 1.2.4

Dependency Of Create On Number Of Servants (1 Thread)

The graph depicts the dependency of the time it takes to create a servant on the number of active servants hosted by the server and the number of active proxies hosted by the client. On the X axis is the number of servants and proxies, on the Y axis is the time it took to create the servant.
Dependency Of Create On Number Of Servants (1 Thread, Zoom)

The graph depicts the dependency of the time it takes to create a servant on the number of active servants hosted by the server and the number of active proxies hosted by the client. On the X axis is the number of servants and proxies, on the Y axis is the time it took to create the servant.
Dependency Of Delete On Number Of Servants (1 Thread)
The graph depicts the dependency of the time it takes to delete a servant on the number of active servants hosted by the server and the number of active proxies hosted by the client. On the X axis is the number of servants and proxies, on the Y axis is the time it took to delete the servant.
Dependency Of Delete On Number Of Servants (1 Thread, Zoom)

The graph depicts the dependency of the time it takes to delete a servant on the number of active servants hosted by the server and the number of active proxies hosted by the client. On the X axis is the number of servants and proxies, on the Y axis is the time it took to delete the servant.
Evaluation

The results indicate a significant increase in the create time and slight increase in the delete time for a large number of servants. The memory usage observed during the test is roughly 1200 bytes per servant instance on the server and roughly 1400 bytes per proxy instance on the client.
VisiBroker 5.1

Dependency Of Create On Number Of Servants (1 Thread)

The graph depicts the dependency of the time it takes to create a servant on the number of active servants hosted by the server and the number of active proxies hosted by the client. On the X axis is the number of servants and proxies, on the Y axis is the time it took to create the servant.
Dependency Of Create On Number Of Servants (1 Thread, Zoom)

The graph depicts the dependency of the time it takes to create a servant on the number of active servants hosted by the server and the number of active proxies hosted by the client. On the X axis is the number of servants and proxies, on the Y axis is the time it took to create the servant.
Dependency Of Delete On Number Of Servants (1 Thread)

The graph depicts the dependency of the time it takes to delete a servant on the number of active servants hosted by the server and the number of active proxies hosted by the client. On the X axis is the number of servants and proxies, on the Y axis is the time it took to delete the servant.
Dependency Of Delete On Number Of Servants (1 Thread, Zoom)

The graph depicts the dependency of the time it takes to delete a servant on the number of active servants hosted by the server and the number of active proxies hosted by the client. On the X axis is the number of servants and proxies, on the Y axis is the time it took to delete the servant.
Evaluation

The results indicate a significant increase in the create and delete times for a large number of servants. The memory usage observed during the test is roughly 2400 bytes per servant instance on the server and roughly 2200 bytes per proxy instance on the client.
Summary

Dependency Of Create On Number Of Servants (1 Thread)

The graph depicts the dependency of the time it takes to create a servant on the number of active servants hosted by the server and the number of active proxies hosted by the client. On the X axis is the number of servants and proxies, on the Y axis is the time it took to create the servant.

![Graph showing dependency of create on number of servants (1 thread)](image-url)
Dependency Of Create On Number Of Servants (1 Thread, Zoom)

The graph depicts the dependency of the time it takes to create a servant on the number of active servants hosted by the server and the number of active proxies hosted by the client. On the X axis is the number of servants and proxies, on the Y axis is the time it took to create the servant.
Dependency of Create on Number of Servants (1 Thread, Zoom)

Swapped Client Memory

Client Kernel Memory

Resident Server Memory

Swapped Server Memory

Server Kernel Memory

Client Network Bytes Sent

Client Network Bytes Received

Client Network Packets Sent

Client Network Packets Received

- Orbix 2000 5.1
- TAO 1.2.4
- VisiBroker 5.1
Dependency Of Delete On Number Of Servants (1 Thread)
The graph depicts the dependency of the time it takes to delete a servant on the number of active servants hosted by the server and the number of active proxies hosted by the client. On the X axis is the number of servants and proxies, on the Y axis is the time it took to delete the servant.
Dependency Of Delete On Number Of Servants (1 Thread, Zoom)

The graph depicts the dependency of the time it takes to delete a servant on the number of active servants hosted by the server and the number of active proxies hosted by the client. On the X axis is the number of servants and proxies, on the Y axis is the time it took to delete the servant.
Evaluation

The results rate Orbix as the fastest broker in the scope measured by the suite for both creation and deletion of objects, TAO occupies the second and VisiBroker the third place. Orbix exhibits the best shape of dependency on the number of servants, TAO occupies the second and VisiBroker the third place. Orbix exhibits the smallest memory usage, TAO occupies the second and VisiBroker the third place.