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WEBINAR

Scalability and Performance Testing with the OpenDDS Bench Framework

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AGENDA

- Introduction
- Motivation For Bench
- Current Capabilities of Bench (Part 1)
- Bench Architecture
- Configuring Bench
- Demo
- Bench Capabilities (Part 2)
- Future of Bench
- Q&A

Introduction

ABOUT ME

- Timothy Simpson
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- 15+ years performance-oriented C++ development
  - Remote Sensing, Defense, Financial Industries
  - Embedded & Real-Time Processing
- Principal Software Engineer @ Object Computing
  - 5+ years with OCI
  - 3+ years on the OpenDDS project

What is Bench?

OpenDDS "Bench" is a scalability and performance-testing framework for enabling large-scale testing of OpenDDS discovery and transport mechanisms

- Currently resides in the OpenDDS repository under `performance-tests/bench`
- Current documentation resides under `docs/internal/bench2.rst`
- Small test scenarios are run during OpenDDS CI process for GitHub pull requests
- Larger scenarios are run in an OCI test environment after each merge to master
    - Results are published to: http://scoreboard.ociweb.com/bench2

Motivation

Motivation for Bench (v2)

Previous Iteration of Bench:

- As seen on https://opendds.org/about/performance.html
- Able to:
  - Capture latency, jitter, and throughput values
  - Support a number of QoS settings and transport configurations
- Limitations:
  - Limited support for different network / participant topologies
  - No statistics for discovery times or machine statistics (e.g. CPU utilization)
  - “Heavy” wrapper of DDS (support for new configurations required new test code)
  - Active IO during tests (SSH connections to in tests, disk IO for writing raw statistic values)

Capabilities (Part 1)

Capabilities of Bench (v2)

- Parity with Bench v1
  - Support for the same basic statistics, scenarios, and outputs as Bench v1
- Ability to test OpenDDS correctness and performance at larger scales
  - Support for increasing number of machines and arbitrary network / DDS entity topologies
  - Support for arbitrary OpenDDS configurations without additional test code
- Better isolation of test performance
  - No test framework network IO activity during active test period
  - Test processes avoid non-OpenDDS memory allocations or disk IO during active test period
- Support for more kinds of statistics
  - Discovery times and "per-node" statistics (e.g., CPU and memory utilization)

Architecture

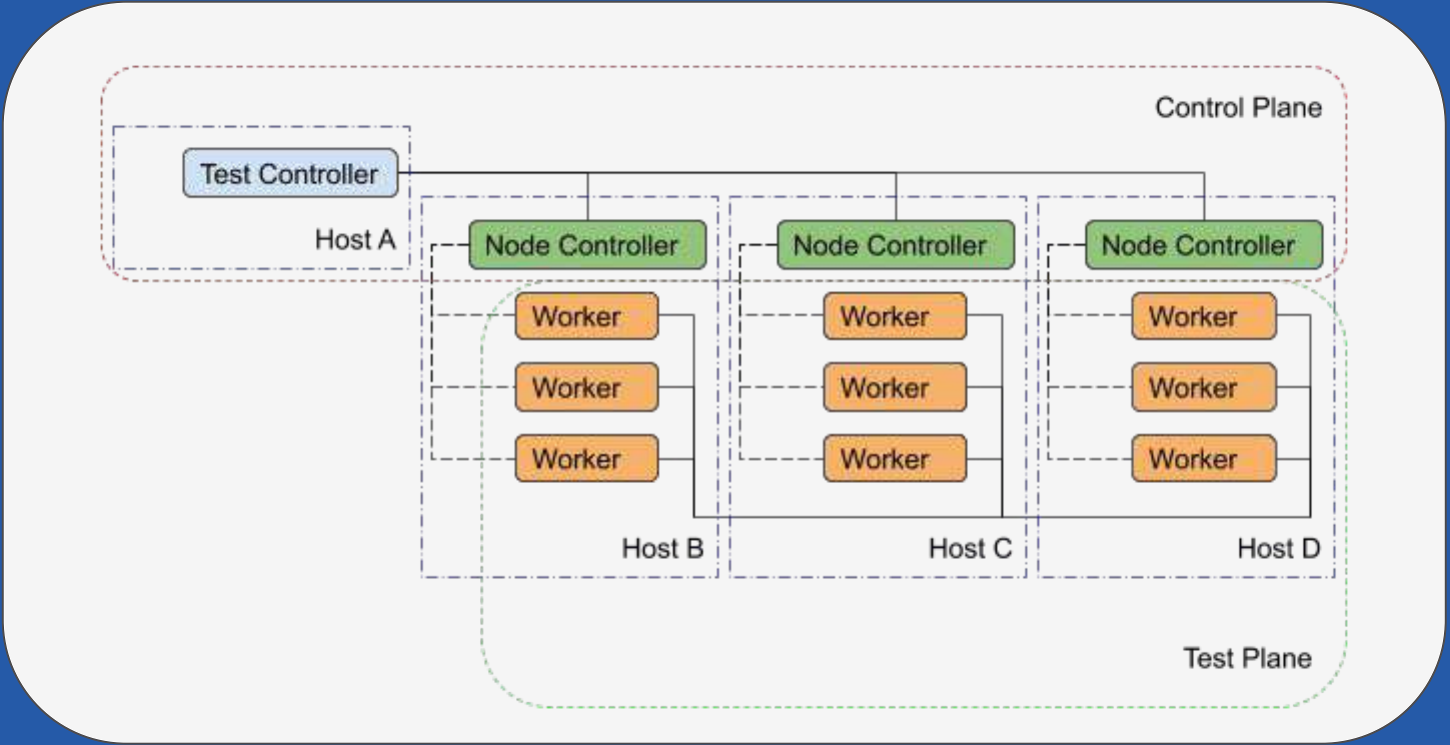
Bench Architecture: Three Process Design

- "Worker" Process:
  - Does most of the "test" work
  - Creates and destroys DDS entities
  - Writes and reads DDS sample data
  - Behavior determined by JSON config
- "Node Controller" Process:
  - Listens for requests to launch worker processes
  - Creates and destroys worker processes
  - Collects and reports worker outputs
- "Test Controller" Process:
  - Runs JSON scenario configuration files
    - Worker files and counts, node constraints
  - Allocates workers to available node controllers
  - Collects node controller and worker reports

Bench Architecture: Two “Plane” Design

- All three processes use DDS for communication
    - To isolate test performance data, DDS communication operates on two different planes
- Test Plane
    - Worker-to-worker test traffic
- Control Plane
    - Requests from Test Controller to Node Controllers
    - Reports from Node Controllers to Test Controller

Bench Architecture



Configuration

Worker Configuration Files

- Sections:
    - Test Timings (enable / start / stop / destruction)
    - Global Parameters
    - OpenDDS Configuration Sections (.ini equivalent)
    - DDS Entities (participants / topics / writers / etc)
    - Test “Actions”
        - Write New Sample Data (count / rate / size)
        - Forward Received Sample Data
        - Set Content Filtered Topic Parameters

Worker Configuration Files (Examples)

Echo "Client" Example

Echo "Server" Example

Scenario Configuration Files

- Sections:
  - Name / Description
  - Full-Node Descriptions
    - For when workers must run on the same node
    - Includes counts and “exclusivity”
  - Any-Node Descriptions
    - For when workers may run on any free node
    - Includes counts
  - Test Timeout

Scenario Configuration Files (Example)

Echo Test Scenario (using client & server from before)

Demo

Capabilities (Part 2)

Current Active Use of Bench

- OpenDDS Continuous Integration
  - Currently used for a number of light-weight stress tests on GitHub pull request workflows
- OpenDDS Performance Tracking
  - Merges to OpenDDS master branch are pulled down to an internal OCI test environment
  - A number of larger performance test scenarios are run for each merge commit
  - Results are post-processed and made available on our performance dashboard
  - Legacy (Bench v1 style) results are uploaded to performance web page
- Rapid Prototyping / Debugging
  - Theoretical Deployments: Checking for performance bottlenecks / modeling QoS
  - Bug Duplication: Reproduce client issues without client code
  - Easy Portability: Code available to clients, configuration files easily shared

Future Capabilities

Potential Future Capabilities of Bench

- Cleaner JSON Configuration Files, Support for Schemas
- Better Support for DDS Security Scenarios
- Statistics for Builtin Topics
- Additional Statistics (dropped packets, or alternative throughput calculations)
- Support for Easier Display of Time-Series Statistics
- Allow Multiple Test “Phases” For Simulating Topology Changes
- Support for User-Supplied Types (for testing Serializer and XTypes performance)
- Others: What would be of value to current and potential OpenDDS users?

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- ... and more!

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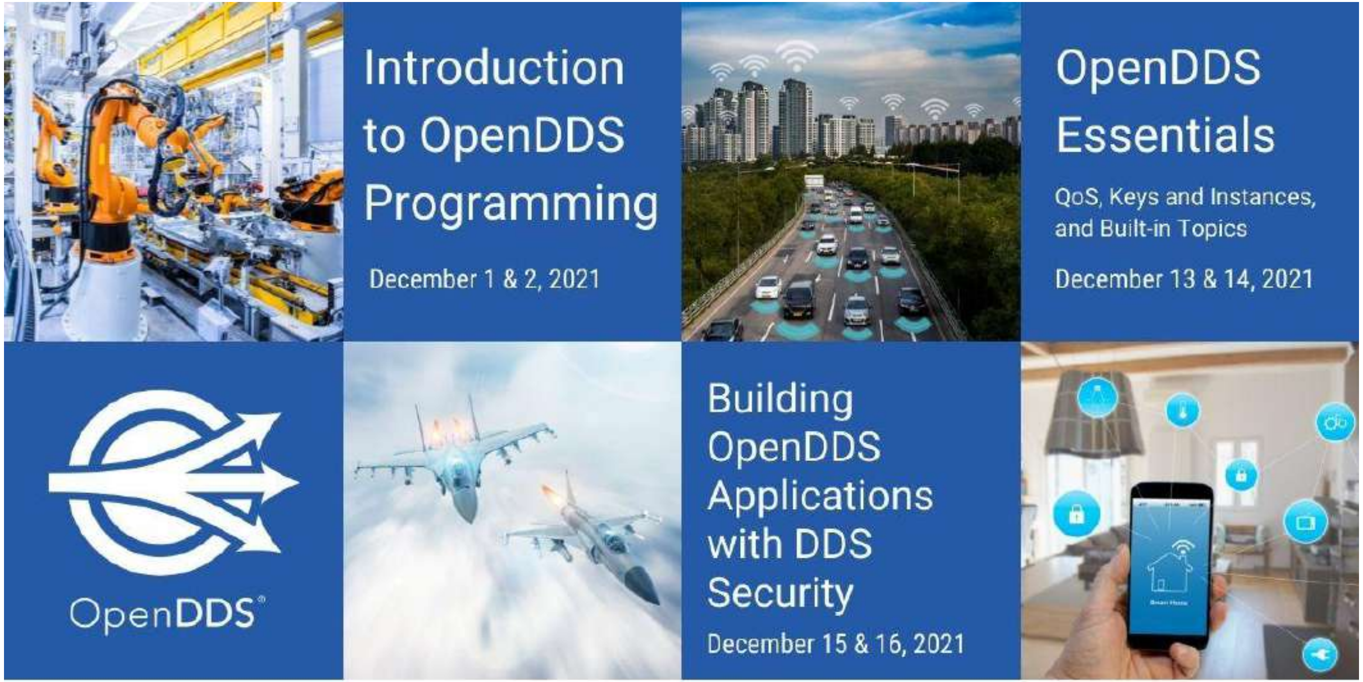

Introduction to OpenDDS Programming

December 1 & 2, 2021

OpenDDS Essentials

QoS, Keys and Instances, and Built-in Topics

December 13 & 14, 2021

Building OpenDDS Applications with DDS Security

December 15 & 16, 2021

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Q&A

THANK YOU!

LET'S CONNECT

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