SPAWAR
Systems Center Charleston

Profiling and Testing Procedures for a Net-Centric Data Provider

Derik Pack
Special Communications Project Support
SPAWAR Systems Center Charleston

SPAWAR
Systems Center Charleston

Net-Centricity

- **Definition**
  - A global web-enabled environment that promotes information sharing, sense making, and decision making.
- **Pillars of Net-Centricity**
  - Physical Infrastructure
  - Software Concepts and Infrastructure
  - Business Logic and Policy

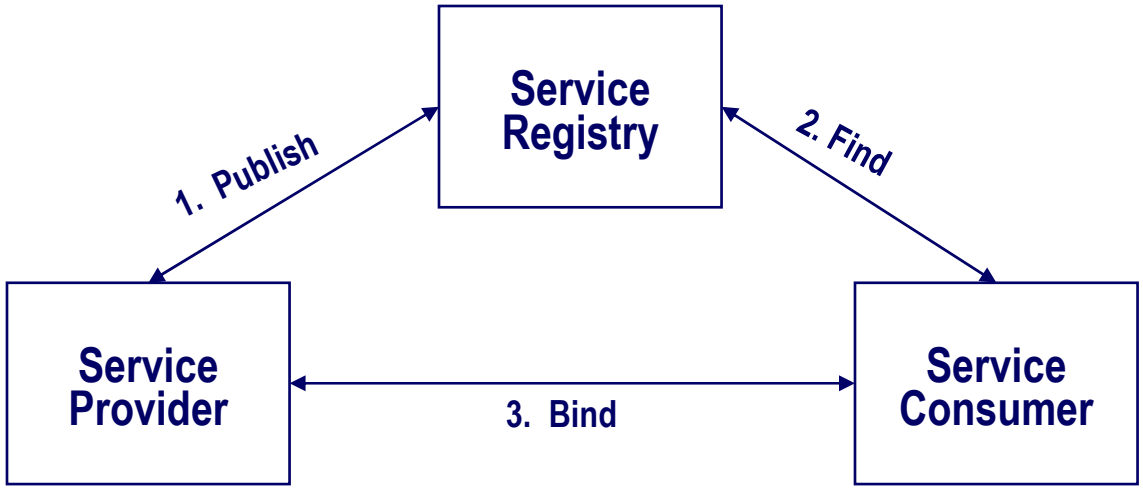
SPAWAR
Systems Center Charleston

Outline

- **Approaching Net-Centricity: Services**
  - Advantages
  - Barriers to Acceptance
- **An SOA Example: Net-Centric Diplomacy**
  - Specifications
  - Architecture
  - Testing Metrics, Procedures, and Results
  - Operational Dashboard
- **Lessons Learned**

An Intro to Service Oriented Architecture

- Operating system and programming language independent
- Expose business processes
- Loosely coupled



SPAWAR
Systems Center Charleston

Web Services

- **Transport over HTTP or HTTPS**
- **Specifications**
  - XML, SOAP, SAML, UDDI, WSDL
- **Competing Organizations**
  - WS-I
  - W3C
  - Vendors

SPAWAR
Systems Center Charleston

Advantages of SOA

- Lower cost of development
- Higher component reuse
- Process streamlining
- Smoother integration paths

SPAWAR
Systems Center Charleston

SOA Barriers to Acceptance

- **Standards**
  - Misunderstanding of Standards
    - Standards can be complex and documentation may be sparse
    - A certain level of knowledge is needed to understand the interaction between standards
  - Policy Issues
    - An implemented standard may impose requirements contrary to the accepted policy of an organization
  - Interoperability
    - Vague or poorly documented areas in a standard may lead to interoperability issues

SPAWAR
Systems Center Charleston

SOA Barriers to Acceptance

- **Technical**
  - Security
    - XML is plain text
    - No explicit security model with SOAP
  - Performance
    - Processing SOAP is CPU intensive
    - Security information can further decrease performance
  - Quality of Service
    - Web services implemented using transfer mechanisms that do not ensure quality of service
  - Transaction Support
    - No implicit support for ACID (Atomicity, Consistency, Isolation, and Durability) transactions

SPAWAR
Systems Center Charleston

SOA Example: Net-Centric Diplomacy

- **Department of State Program**
- **Electronic Publishing of Post Information**
  - Biographic reports
  - DoS telegraphs
- **Initiative of Horizontal Fusion Portfolio**
- **Uses DISA's Net-Centric Enterprise Services**

SPAWAR
Systems Center Charleston

Horizontal Fusion

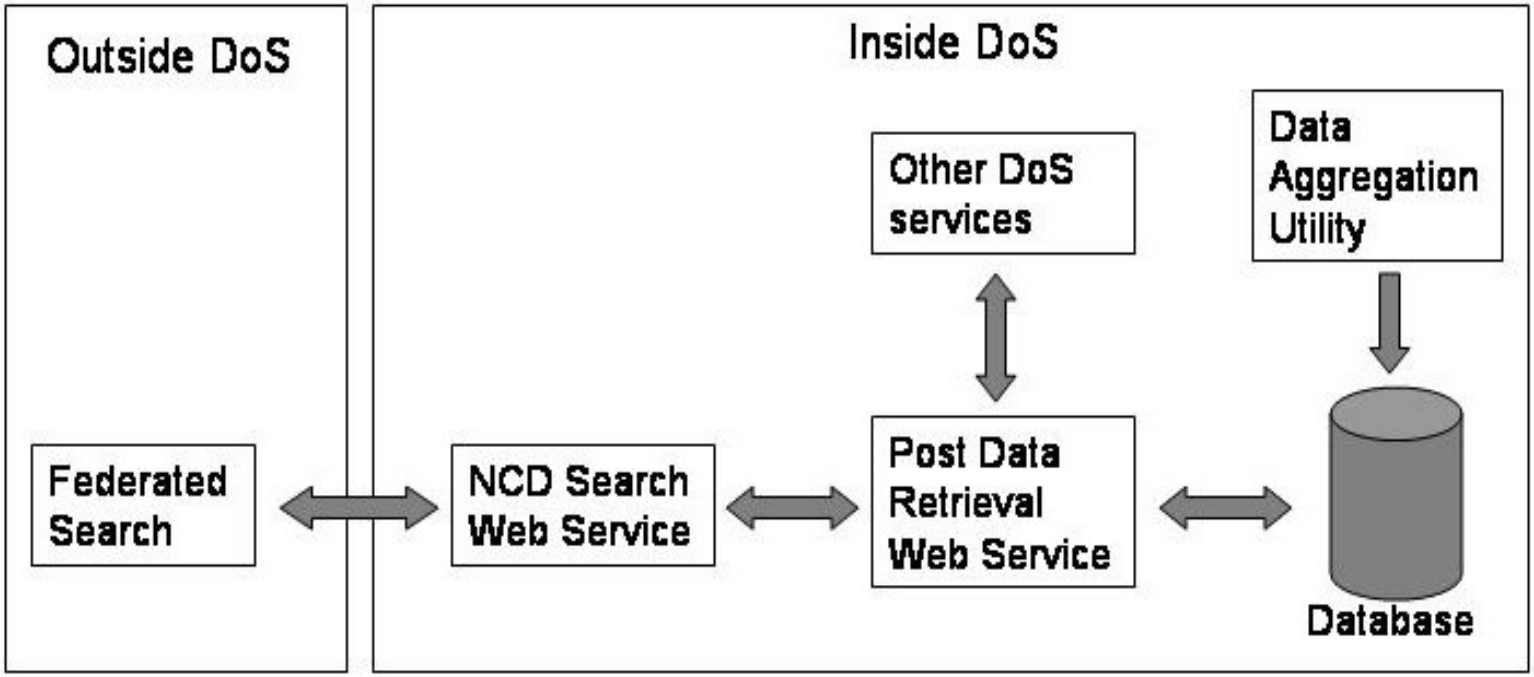
- Department of Defense Portfolio
- Providing example application layer of Global Information Grid (GIG)
- Using DISA's Net-Centric Enterprise Services (NCES)
- More information can be found at http://horizontalfusion.dtic.mil/

NCD Data Provider Implementation

- **NCES interaction**
  - Security Services
  - Discovery Services
- **Intelligent Federated Index Search (IFIS) WSDL**
  - Web Service Interface
  - Query Syntax
    - Person Search
    - Keyword Search
- **ncd_search_1_2**
  - search
  - cancelSearch
  - getMoreResults

SPAWAR
Systems Center Charleston

NCD Architecture



SPAWAR
Systems Center Charleston

Problems of measuring web service performance

- **Few exhaustive web service performance tools exist**
- **Web services are not websites**
  - The same metrics may not apply
  - Services may call other servers/services
  - Service(s) may encompass business logic to be tested
  - Semantic use of the service is not clearly defined

Solutions for Web Service Performance Testing

SPAWAR Systems Center Charleston

- Define web service specific performance metrics and tests
- Monitor dependent environment during performance testing
- Create dashboard application for production environments for quick diagnostics of all dependencies

SPAWAR
Systems Center Charleston

Web Service Performance Metrics

- ***Round Trip Time (RTT)***
  - The time required for a request to be sent from a client, processed by the server and returned
- ***Error***
  - Incorrect results or error messages received from the web service
- ***Connections per Second (CPS)***
  - The number of connections that are being sent to the web application each second
- **(IFIS specific) Queries per Second**
  - The number of queries (search+getMoreResults calls) till a client has received all possible results

SPAWAR
Systems Center Charleston

Test Types

- **Continuous test**
  - Set a constant connection rate and time of the test
- **Ramped Test**
  - Set a start and end connection rate and a number of steps to increment the rate between the start and end of the test
- **Burst Test**
  - Set a one time burst of connections
- **Adaptive Test**
  - Search for the steady state connection rate for the service in an adaptive manner

SPAWAR
Systems Center Charleston

Dependency Testing

- **Required while using web service metrics**
  - To map low performance to a given component
  - Determine which components can provide greatest speedup to service
- **Testing includes**
  - Unit testing
  - Application profiling (CPU and memory)
  - Correct software configuration for given hardware

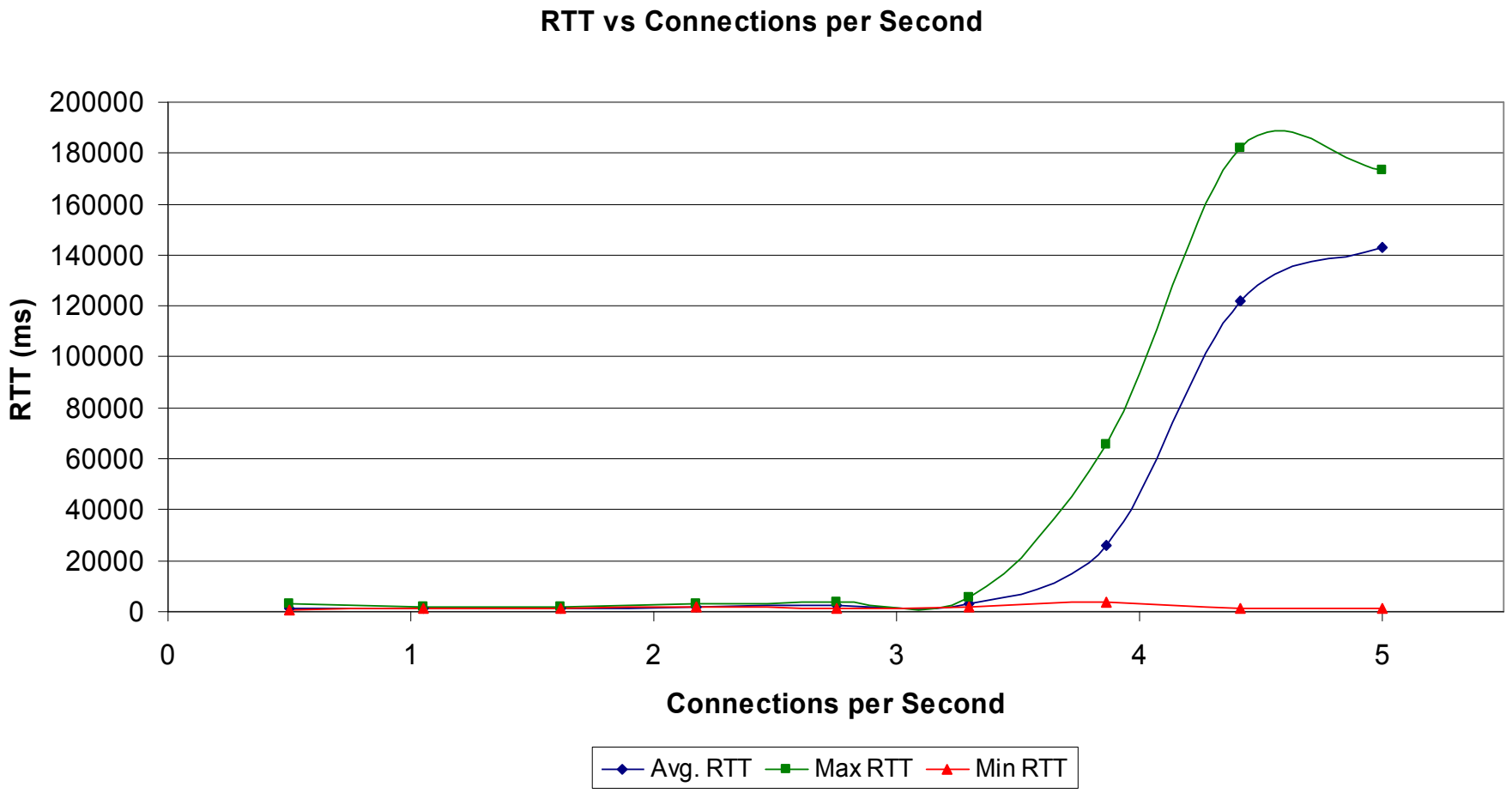
SPAWAR
Systems Center Charleston

Testing Procedures

- Burst tests and profiling for memory problems
- Continuous tests and error logging for functional testing
- Ramped tests to determine point of failure for server
- Adaptive tests based on the point of failure to find steady state connection rate of the server

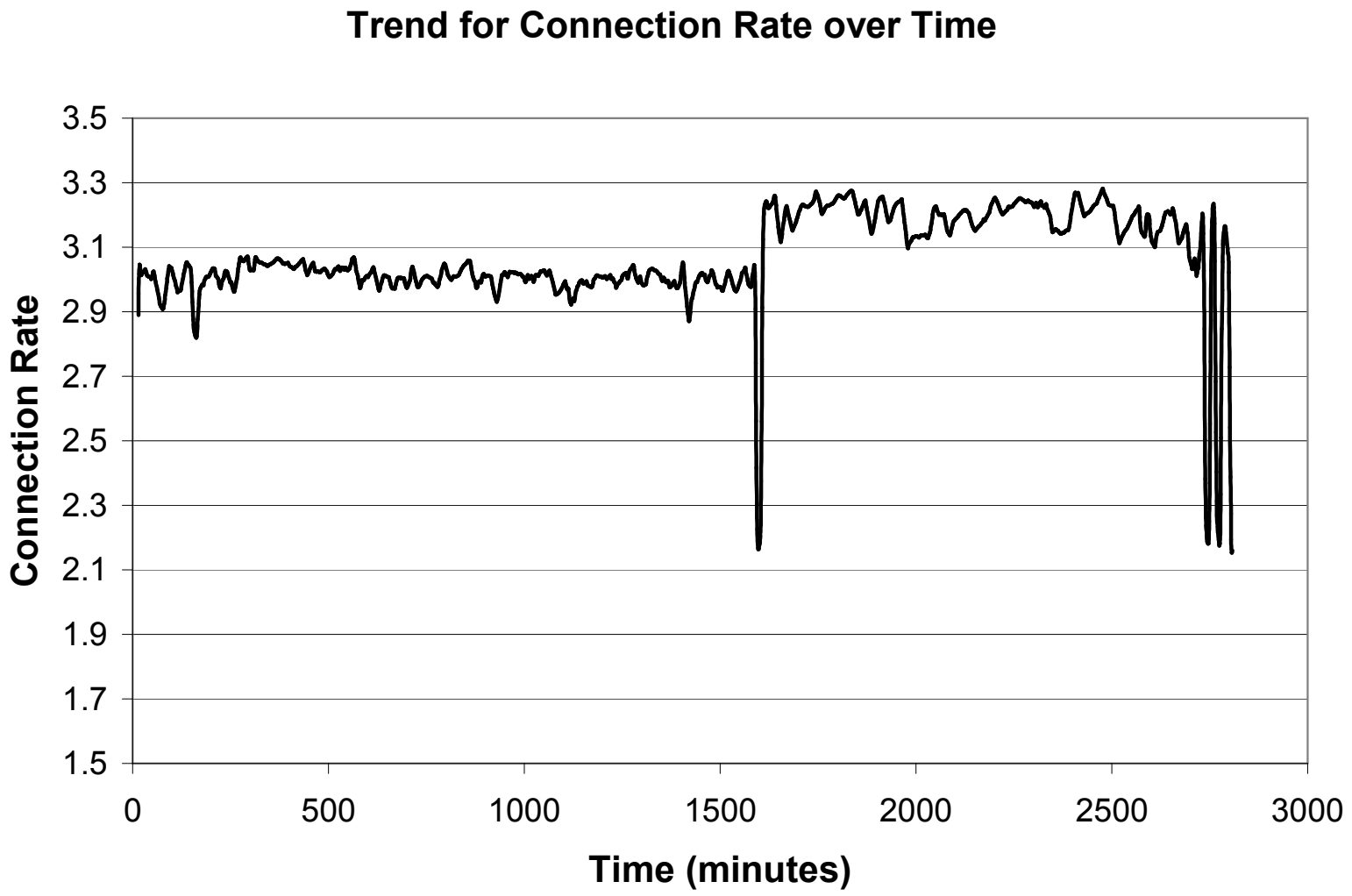
SPAWAR
Systems Center Charleston

Ramped Test



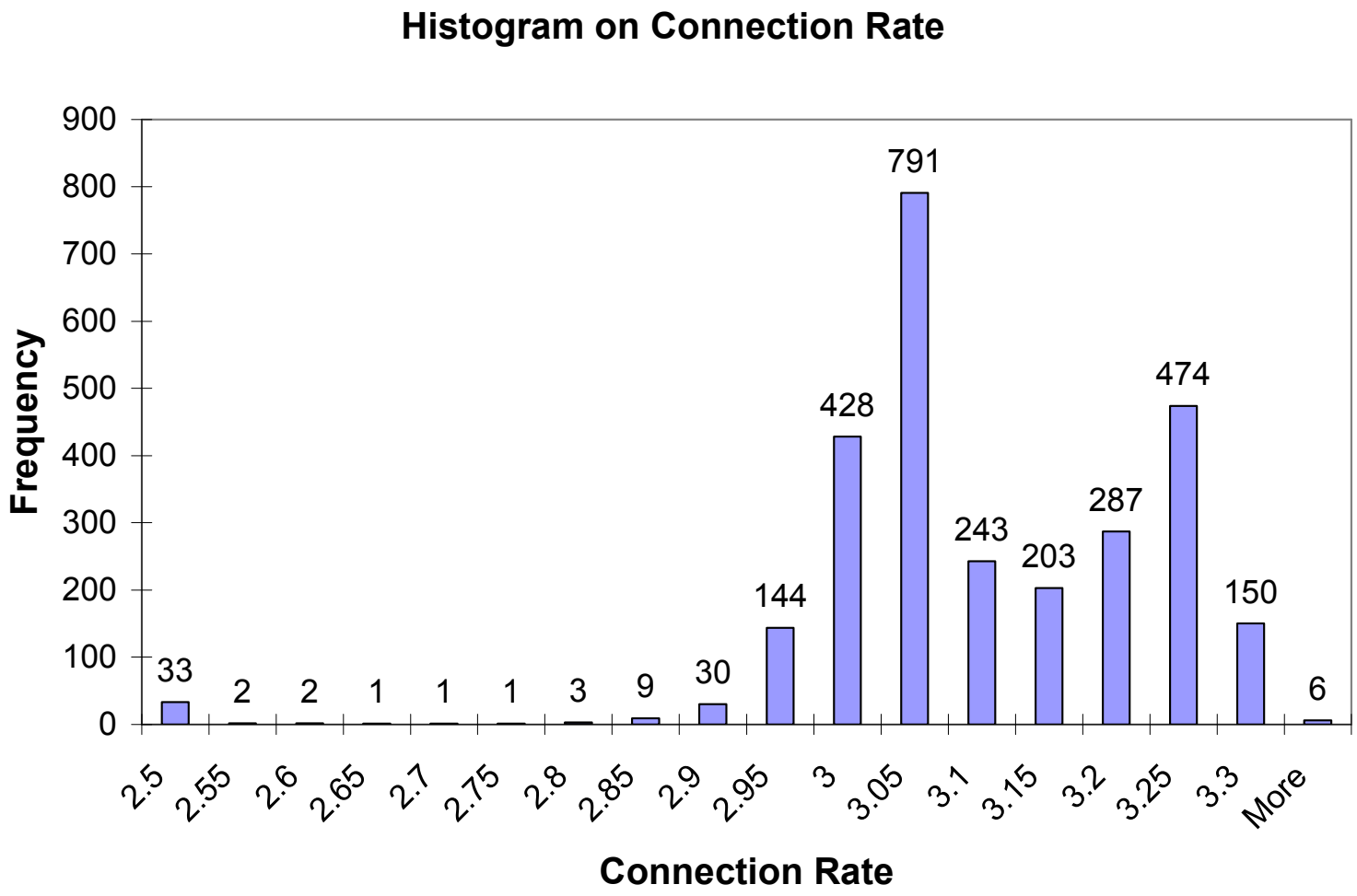
SPAWAR
Systems Center Charleston

Adaptive Test over 48 hours



SPAWAR
Systems Center Charleston

Histogram of Connection Rate



SPAWAR
Systems Center Charleston

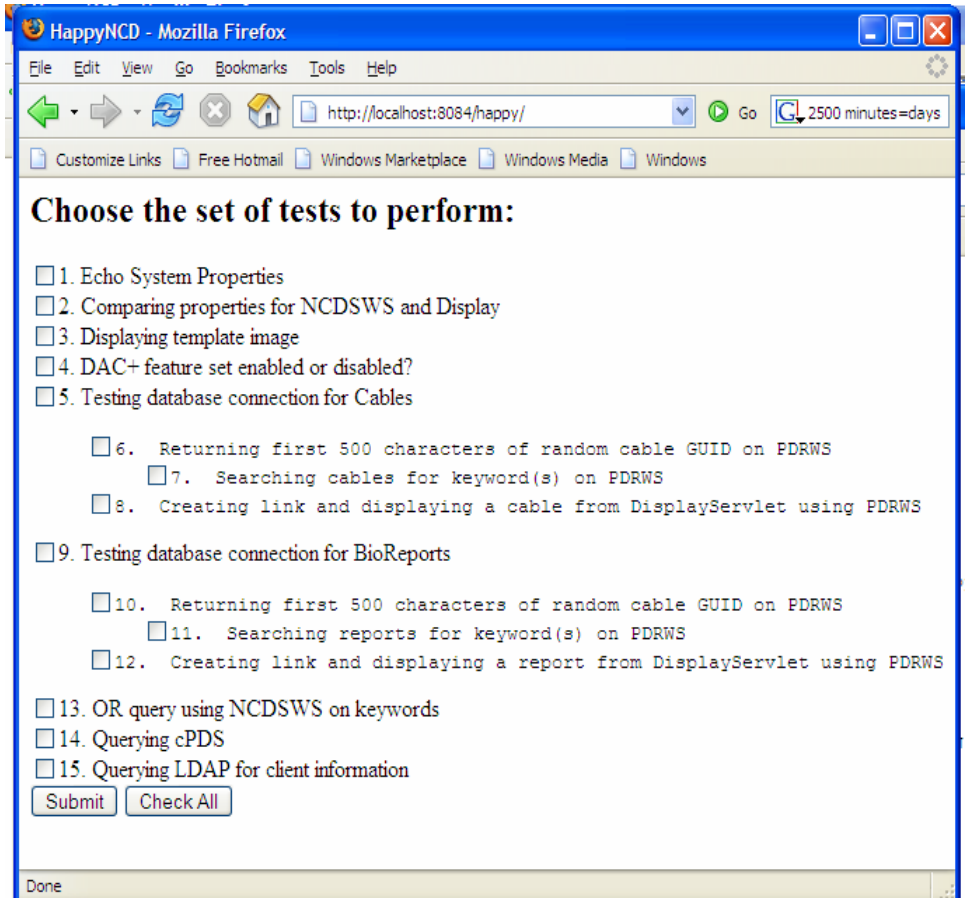
Adaptive Test Results

- **Spikes at 26 and 48 hours**
  - Not consistently reproduced in other tests
  - Can be attributed to environmental factors when testing at a nominally stable service load
- **Mean connection rate of 3.06 connections/second with a 99% confidence of 0.01**
- **Test covers a likely query method for service not all query methods for the service.**

SPAWAR
Systems Center Charleston

Dashboard

- **Web based client that monitors**
  - Department of State web services
  - Required external web services
  - Database
  - Current application configuration
- **Decreases diagnostic time in development and operations**



SPAWAR
Systems Center Charleston

Conclusions

- Web services can make testing more iterative and time consuming
- Constant race to best characterize the operational environment because web service interface makes it easily change
- Best test plan covers many possible uses of web service interfaces

SPAWAR
Systems Center Charleston

Questions?

Author Contact Information

Derik Pack

843-515-5015

SWAWAR Systems Center Charleston

derik.pack@navy.mil