



Custom Online Assessments

Online Assessment System

SITE NETWORK INFRASTRUCTURE GUIDELINES

February 15, 2012

User documentation for Technology Coordinators

This document provides technical information and guidelines to help you set up your test workstation network and communications.

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Introduction

The CTB Online Assessment System’s Test Delivery Client (TDC) is a locally-installed application that interacts with CTB servers using standard, secure internet communication protocols. A locally-installed client provides several advantages to summative assessment delivery:

- **Locked-down environment:** Prevents access to other applications (for example, browsers, IM clients, email, reference materials, etc.). This ensures that the only activity the student can engage in on the workstation is test-taking.

Environment lockdown features include keystroke interception (including system-level inputs like Ctrl-Alt-Del, Alt-Tab, etc.), a process blacklist and process suppression, forced full-screen presentation, and other features to ensure the student cannot divert from the test.

- **Consistent student experience:** Maintains consistent test content progress (for example, navigation between items) even as network performance varies. The TDC has separate user interface and network communications modules so server transfers and user test navigation are handled independently and asynchronously.
- **Low bandwidth:** Local disk on the workstation is used to pre-position and cache encrypted test content. Thus, the TDC reduces bandwidth requirements and enhances the student experience. Additionally, TDC maintains detailed log and audit information (the latter again encrypted) on the local disk to aid troubleshooting and enhance non-refutability without increasing network load.

The TDC uses platform-independent Adobe® AIR® for the student user interface on PC and Linux operating systems, Adobe® Flash® on Mac, and Java Runtime Environment™ (JRE) for network interactions, data management, encryption/decryption, etc. A separate platform-specific (for example, Windows, Mac, or Linux) component provides the application lockdown and security functions.

The Online Assessment executable launched from a desktop shortcut starts up and orchestrates all the components.

Environment Guidelines

In order for the TDC to work efficiently, the following conditions must be met on each workstation:

- Appropriate versions of Adobe® AIR® (or Adobe® Flash® for Mac) and the Java Runtime Environment™ must be installed and runnable by the logged-in user during testing. See the Online Assessment *Installation Guide* for the platform requirements.
- The TDC must be installed, and the logged-in user must be able to launch the Online Assessment executable.
- The Online Assessment executable must not be prevented from executing Java.

- The Java executable must not be prevented from executing other processes.
- The Java executable must be able to make HTTP/HTTPS connections on ports 80/443 to *.ctb.com addresses.
- The logged-in user must have write access to the folders and subfolders in which you installed the TDC.
- If a proxy server is in use, the proxy host, port, username and password must be specified in the file.

[TDC Installation folder]/Online Assessment/etc/proxy.properties.

- For best performance, pre-position encrypted content files in the folder.

[TDC Installation folder]/Online Assessment/data/objectbank.

Prepositioning can be done either manually or using the administrative application. See the *Installation Guide* for pre-positioning instructions.

If the content is not pre-positioned, the TDC downloads it after each student log in. Test content does vary from test to test; however, it can easily exceed 10 megabytes. If multiple students log in simultaneously, this can congest the network bandwidth and interfere with test performance.

Bandwidth/Connectivity Guidelines

Internet

The TDC per-student bandwidth requirements are quite modest. When content is pre-positioned, the TDC requires on average ~10 kilobits per second per student. This means that approximately 100 students can be supported by a 1 megabit per second connection.

There are many factors to consider besides available bandwidth when determining how many students can test at once. The TDC incorporates several mechanisms that increase its tolerance for network faults and performance fluctuations. However, it cannot totally compensate for an unreliable connection that causes repeated failures to send and receive acknowledgements, lengthy transmissions or response delays. The net effect is uneven, unpredictable test presentation, a painful experience for both students and test administrators, especially if the occurrence is repeated or widespread.

In our experience, an unstable, high-bandwidth connection is more likely to compromise the test experience than a low-bandwidth, stable connection. For example, we have had sites with a 1.5 megabit/sec T1 line successfully test 200 students at once while another site with an unreliable, 10-Mbs service had problems with fewer than 100 students.

The TDC is currently in use at hundreds of locations throughout the country with every sort of network configuration imaginable. To confirm that each test site has sufficient network connectivity and bandwidth to support full TDC functionality, run the Network Utility included in the TDC download during workstation set up.

Local Network

Variations in LAN topology and equipment should have little impact on the TDC, provided each workstation has the necessary connectivity and adequate bandwidth to the CTB servers. However, there are a few LAN-related considerations to ensure efficient testing.

- Networks and workstations at test sites are seldom if ever devoted exclusively to test delivery. For example, it is not unusual for a site's ISP connection and/or local network to be 50-75% utilized or more during test windows. This means that far less than the nominal bandwidth of that connection is available for testing.

Monitor your local network and ISP connection ahead of testing to determine likely actual conditions. Use this information to make a more realistic assessment of how many workstations can be used concurrently at a site. The Network Utility included in the TDC download, distributed along with the test delivery client, can help in

this assessment. Be sure to run it during the timeframes in which you will be testing.

- Many sites use wireless devices for local network connectivity. There's no fundamental issue with using a wireless connection with the TDC; but keep in mind that wireless connections are generally less reliable than wired connections. We recommend using wired LAN connections for the test workstations whenever possible. If wireless is to be used, consider the following in addition to the general bandwidth and connectivity requirements:

When multiple workstations use a WAP or wireless router, the total bandwidth available is seldom anywhere near the nominal bandwidth of the device (for example, 11Mbit/54Mbit/etc.). This becomes more true the larger the number of connected devices.

The speed and reliability of wireless connections vary greatly with the relative positions of, distance between, and even physical orientations of the WAP and the workstations.

Many devices, especially common consumer-grade hardware, do not provide reliable connections to more than a relatively limited number of devices simultaneously. While we can't provide make/model-specific data, approximately 20 devices per WAP seems to be a common reliability threshold.

Keep in mind that if a single upstream port on the WAP or wireless router is used to connect to the wired network, the speed of that port also constrains total bandwidth available to the connected devices.

- While it is increasingly uncommon, we still see test workstations attached to unswitched wired network devices such as a hub. If you have such an arrangement, and especially if you have multiple levels of aggregation (that is, workstations connect to hubs which connect to other hubs), the actual bandwidth available to a given workstation may be severely limited. We strongly recommend a fully switched local network infrastructure.

Network Utility

We continue to refine the TDC software to provide a smooth, interruption-free user experience over a broad range of situations. But it's always important to assess actual client in-place behavior before you start the testing cycle. A useful assessment tool is the Network Utility provided in the TDC download.

The Network Utility is a simple, easy-to-use program that performs three tests:

- **Network connectivity:** Confirms that the workstation can connect to the CTB servers to conduct the online test.
- **Bandwidth simulation:** Confirms that your connectivity is robust enough for the number of test workstations at that location. The Network Utility simulates the bandwidth used by your test workstations and indicates the likelihood of interruption-free service.
- **Text to speech:** Confirms that the workstation can interact correctly with the CTB text to speech (TTS) server used for screen-reader accommodated students.

See the *Network Utility User Guide* for instructions.