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JCATS V14.0 Hardware and NET Requirements

This document details the necessary hardware, software and ancillary equipment required to support Lawrence Livermore National Laboratory's (LLNL) Joint Conflict And Tactical Simulation (JCATS) New Equipment Training (NET).

JCATS is a client/server based application and is designed to run in a distributed environment. From an environmental standpoint, one computer functions as the server and serves as the disk storage manager (via NFS), authentication server (via NIS) and the print server (via CUPS). This machine is called the JCATS Data Server. The other computers are clients of those services. The server and client workstations are connected to each other via Ethernet (See Figure 1). A printer may be available to print out reports and screen prints.

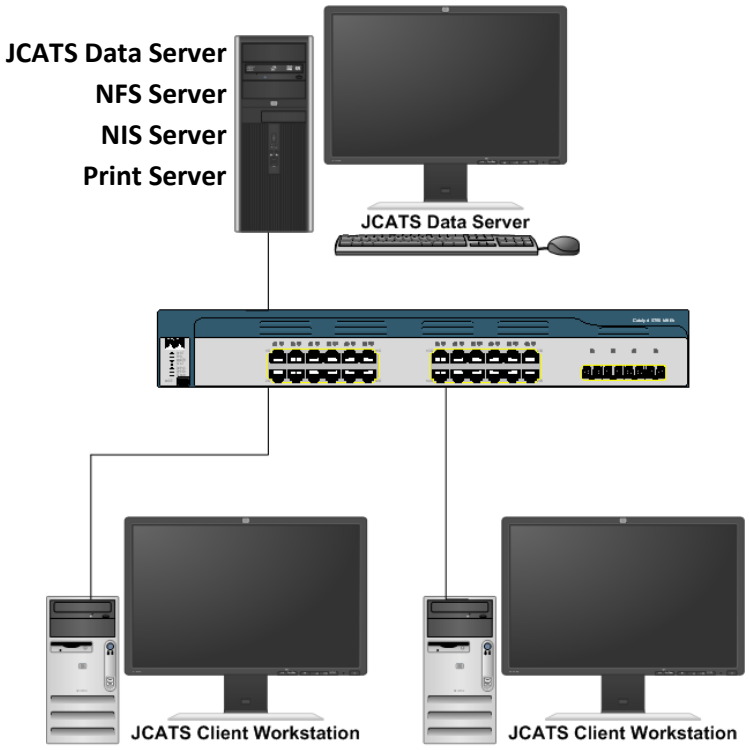


Figure 1

The JCATS simulation engine has one process called *jcatsSim* and it is responsible for all calculations required by the simulation. The simulation process is typically run on the computer with the most CPU performance and memory, but can be run on any system that is authorized to run it. The machine running the simulation is called the Simulation Server. In most configurations the simulation server also acts as the NFS, NIS and CUPS server. The JCATS simulation communicates with the JCATS clients using both TCP/IP and UDP/IP (broadcast) protocols.

The simulation user interface process is called *jcatsClient* and is run on JCATS Client Workstations. The client workstation is the visual and user interface to the simulation.

NOTE: If desired, a force can be assigned to the Simulation Server as long as it meets the minimum display requirements.

The JCATS software suite also includes editors and simulation interface tools used to control the simulation. The editors and other tools can be used independently of the simulation and the clients.

JCATS can generate substantial network traffic therefore; a 1Gb certified network installation is critical to proper JCATS operation.

JCATS hardware requirements are heavily dependent upon the scenario design, such as, the number of entities in a game, the terrain being modeled, the physical placement of entities on the terrain, the interaction of entities during the game and real-time player interaction with the simulation.

JCATS is supported on Intel x86 based computers running Red Hat Enterprise Linux (RHEL). JCATS supports only 64-bit processor architecture (Intel 64/AMD64 – not IA-64 Itanium). The hardware requirements listed below should support most simulations with an entity count of approximately one-hundred thousand. This was determined empirically based on current JCATS use. No algorithms exist to determine the exact hardware performance requirements as there are too many variables for such a calculation to be performed.

JCATS memory requirements are heavily dependent on the size of the JCATS scenario and terrain used in the simulation. For server system, a general rule-of-thumb is; if the simulation entity count is greater than 100 thousand its recommend to use the ‘Recommended” amount of memory (32GB). For client workstations with terrain’s greater than 750 MB we recommend using the ‘Recommended” amount of memory (16GB).

JCATS is a single-threaded application and will use only one core of the multi-core CPU processors that are available on the market today. Therefore, it is best to buy the fastest processor available for your simulation requirements. Because JCATS simulation process uses only one core this does not mean the other cores are unused. The other processor cores will be used when running other JCATS simulations on the same host, JCATS tools and editors and for other OS support processes.

JCATS has very specific minimum graphics resolution requirement. The JCATS Desktop Environment and JCATS Client window are sized to a minimum resolution of 1280x1024 (SXGA). The 1024 pixel vertical resolution is very important to display the JCATS environment correctly. JCATS client workstation displays should not be lower than SXGA resolution. Many new laptops and monitors are being designed with 16:9 aspect ratio displays that are configured with less than 1024 pixels in the vertical resolution. JCATS users need to be careful and pay close attention to the screens resolution so they do not purchase displays with less than 1024pixel vertical resolution. The SXGA, SXGA+, WSXGA+, HD 1080, UXGA, WUXGA, and QXGA are all JCATS compatible resolutions. Use of wide screen monitors is recommended for maximum user capability.

The JCATS NET is taught in English and therefore requires US/English keyboards. The keyboards can be dual marked with the local language if desired. The JCATS simulation uses all three buttons on the optical mouse for game functions, the ‘wheel’ function can also be used for scrolling during game play.

One note on the purchase of JCATS server hardware, a desktop style machine properly configured can function as a JCATS server. The purchase of a typical rack-mount ‘server’ machine is not necessary unless the local site plan dictates this requirement (e.g. All server hardware must be rack mounted in the server room.). The recommend JCATS computer hardware below uses desktop style hardware for both the JCATS server and clients. Appropriately configured mobile laptop devices could also be used as a suitable JCATS hardware suite.

Computer Hardware Requirements for JCATS

(For RHEL V6.10 users, see the important note under Operating System Software)

JCATS/JLOD Server Requirements:

- CPU: Intel – Kaby Lake or earlier; AMD – Naples or earlier. Fastest possible CPU is better.
- Case: Rugged Mid Tower computer
- Motherboard: High-end Intel or AMD Motherboard
- Power Supply: 850 Watt or better
- Memory: 32GB RAM
- Graphics Card: GeForce GTX 1050, 2GB RAM or better
- Monitor: 24 inch Flat panel WUXGA, 1920x1200 (Minimum 1024 vertical)
- Internal OS Disk: 500GB SATA (3.0Gb/s (min), recommend 6.0GB/s or faster) 7200 RPM
- Internal Data Drive: 1TB SATA (3.0Gb/s (min), recommend 6.0GB/s or faster) 7200 RPM
- Network: Gigabit Network Interface Card (must be supported by required RHEL OS)
- Optical Drive: 20X DVD±RW
- External Backup: 4 Terabyte External SATA/USB Backup Hard Drives
- Keyboard: 104 Normal Keys (US English + local language if desired)
- Mouse: 3-Button Optical with scroll wheel

JCATS/JLOD Client Workstation Requirements:

- CPU: Intel – Kaby Lake or earlier; AMD – Naples or earlier. Fastest possible CPU is better.
- Case: Rugged Mid Tower computer
- Motherboard: High-end Intel or AMD Motherboard
- Power Supply: 850 Watt or better
- Memory: 32GB RAM
- Graphics Card: GeForce GTX 1050, 2GB RAM or better
- Monitor: 24 inch Flat panel WUXGA, 1920x1200 (Minimum 1024 vertical)
- Internal OS Disk: 500GB SATA (3.0Gb/s (min), recommend 6.0GB/s or faster) 7200 RPM
- Network: Gigabit Network Interface Card (must be supported by required RHEL OS)
- Optical Drive: 20X DVD±RW
- Keyboard: 104 Normal Keys (US English + local language if desired)
- Mouse: 3-Button Optical with scroll wheel

JCATS HLA Bridge Client Workstation Requirements:

Any system used to run the JCATS HLA Bridge should have an additional NIC for HLA traffic.

- Network: Gigabit Network Interface Card (must be supported by required RHEL OS) ADDITIONAL

Operating System Software

Most major US hardware vendors can bundle the *Red Hat Enterprise Linux Workstation* license with the purchase of a new computer. JCATS V14.X will be supported on Red Hat Enterprise Linux V6.10 (64 Bit) and RHEL7.5/6 (64 Bit). Should newer versions be released (i.e. RHEL V7.7) during the JCATS V14.X support cycle, those newer versions will be supported in a future patch.

Important Hardware Note for RHEL V6.10 users:
RHEL V6.10 does not support the latest release of Intel Processors (Code Name: Kaby Lake) Some of these processors include: 7740X, 7700K, 7640X, 7600K, 7500, 7400, 7300, etc RHEL V6.10 does support the previous release (Code Name – Sky Lake) Example include: 7800X, 7900X, 6700K, 6600K, 6600K, 6500, etc. More information can be found at: http://access.redhat.com/support/policy/intel

JCATS requires *Red Hat Enterprise Linux Workstation Self-Support*, part number RH0986300. Failure to purchase *Red Hat Enterprise Linux Workstation Self-Support*, part number RH0986300 will result in a JCATS installation failure as only this version has all the required packages.

All RHEL installation media is available for downloading and local burning by the end-user using their Red Hat Network (RHN) account and password setup at time of purchase. When you purchase *Red Hat Enterprise Linux Workstation Self Support* you will receive access to all older versions of the RHEL on the RHN site.

Special JCATS pricing has been arranged through the Red Hat Enterprise Linux official distributer, DLT Solutions of Herndon, Virginia. Contact DLT Solutions and specify you are a JCATS customer; Email: sales@dlt.com Phone: 703-708-9603. Please identify yourself as a JCATS customer to get discount pricing.

JCATS Printing Requirements

A duplex network capable printer is required to print the JCATS documentation, manuals and training materials. These documents and training material consist of many thousands of pages. One or more printers (depending on the installation layout) should be provided for use by the technical staff and for output during training and exercises.

Printers:

- Xerox Phaser 6510/DN Color Laser Printer
- HP Color LaserJet M553dn Printer

Recommended Features/Options/Items:

- Duplex
- Additional Paper Tray(s)
- Maximum memory installed
- Two (or more) of each cartridge used (toner, waste, maintenance, etc)
- One or more boxes of 8.5x11” or A4 paper (based on locale)

Recommended printer locations:

- Server Room

- Tech Control Room
- Main Operation Room

JCATS Network Design and Maintenance

JCATS is a network based client/server simulation which can require the full 1Gb network bandwidth at peak times depending upon the simulations entity count, terrain, player interaction and system engagements during the game. A ‘dedicated’ 1Gb network is required. All simulation hardware connected to the network should also support 1Gb network bandwidth requirement.

JCATS uses TCP/IP UDP broadcast protocol to communicate with all 'client' workstations on the network. The local JCATS network should be designed as a single dedicated IP subnet to support the UDP broadcast design of JCATS. Simply stated, all JCATS simulation computers should have the same IP subnet addressing and not be separated by a router or gateway.

Since JCATS is a network based application it is imperative that the network be installed and correctly maintained. Below is a minimal list of required installation and maintenance tools needed to certify and maintain a network correctly. Certification of the JCATS network cable plant is critical to JCATS functionality. Certification of a JCATS network consists of every cable being tested with a correctly calibrated Ethernet cable analyzer which tests not only pin-out but for proper propagation, delay, crosstalk, attenuation, resistance, etc.

These items are required to ensure that all network cables are made properly and pass the data throughput requirements. Poorly installed/maintained cabling is a major source of JCATS performance problems.

- Fluke DTX-1800 Cable Analyzer and Two (2) International Power Supplies Model DTX-ACUN
- Cisco 3850 Network Switches (Catalyst 3850 Series with Gigabit ports)
  - 1 – 24-Port Version (WS-C3850-24U)
  - 1 – 48-Port Version (WS-C3850-48U)
- Workgroup Switch for standalone and NET classroom (5 or more)
  - NETGEAR GS108 10/100/1000Mbps ProSafe Gigabit Ethernet Desktop Switch
- Uninterrupted Power Supplies (UPS), (Battery Back Up). One per workstation and one per server computer and one for both Cisco switches
- Category 6e Plenum Network Cable
- Professional Grade Network Crimping Tools (e.g. L-com PN: HTS7508C6)
- RJ45 Connectors
- RJ45 Network Outlet Boxes with Face Plates.
- Network conduit/raceway as required for site (if needed)

JCATS High-Resolution Projector Requirement:

Two high resolution projectors are required to support the two classrooms used during the NET. These are required for proper display of the JCATS workstations operating system build demonstrations during the JCATS System Administration course and proper display of the JCATS workstations used in the User and

Database courses. The projectors must be capable of displaying the graphics output through the various changing display modes (VGA, SVGA, etc) used during the RHEL installation and configuration phase.

In addition to the workstation output, a second projector (1024x768 resolution) is required for projecting the Microsoft PowerPoint training materials from instructor's laptop.

A total of four screens will be required to meet the projection requirements.

Projector and Accessories:

2@ Hi-Res (1080p) with DVI/HDMI/DP inputs. Example: Epson Home Cinema 1060
2@ Med-Res (XGA-minimum) with VGA/HDMI/DP inputs. Example: Viewsonic PA503W
4@ 120 inch Projection screens (Day-Lite; Model 38832 preferred)

Network Cable Management Supplies:

These items are required for proper cable management during and after the JCATS NET.

5@ - 15' OF Velcro® Brand ONE WRAP® TAPE, Hook on The Front, Loop on the back
5@ - Rolls 2-3" Wide Duct-Tape
3@ - Wire Marking Tape Rolls (CableOragnizer PN: ZT-MM-WMD)

Uninterruptable Power Supplies (UPS)

Reliable power is also a major concern for any simulation center. It is recommended that if the power at the site is subject to sags, spikes, momentary interruptions or sporadic outages that UPS units be specified. The site should purchase one UPS for each computer/monitor and the networking hardware. Special attention should be paid to the power receptacles to assure that computers and peripherals are supported with the appropriate connections.

Uninterrupted Power Supplies (UPS) (choose number and size appropriate for computers/monitors purchased)
For example: APC Back-UPS or Back-UPS Pro (APC Back-UPS Pro, 1500)

Power Strips:

High quality power strips are required to connect the many power requirements of the site. Low-cost, low-quality, outlet strips should be avoided because of their high failure rate and low quality assurance standards.

6-Receptical Universal Outlet 250 Volt Modular Power Strips with appropriate cord for country. The simulation center will require at least one per computer, printer, network switch and projector. (E.g.: International-electrical-supplies.com PN: WE-4A or equivalent premium grade universal outlet strip)

Training Requirements

Prerequisite Red Hat Enterprise Linux System Administration Courses

The Red Hat system administration courses or one year of full-time Linux/UNIX system administration experience are required as prerequisites for the JCATS System Administration Course.

One year of fulltime Linux/UNIX system administration experience.

– OR completion of the following course work. –

- Red Hat Enterprise Linux Technical Overview (RH024) Course (Video Online - Free)
- Red Hat Enterprise Linux System Administration I (RH124) (5 days)
- Red Hat Enterprise Linux System Administration II (RH134/5) (4/5 days)
- Red Hat Enterprise Linux System Administration III (RH254/5) (4/5 days) (Optional)
- Red Hat Enterprise Linux Diagnostics and Troubleshooting (RH342/3) (4/5 days) (Optional)

JCATS NET Schedule

The JCATS NET schedule is three weeks long. All courses are taught in English. If the student's English skills are insufficient then interpreters should be used. This is especially true during the JCATS System Administrators course where proficiency in technical English is critical. The course materials are designed for an eight hour training day.

Week 1 - JCATS System Administration Course Setup (no training involved)

Week 2 – JCATS System Administration Course

Week 3 – JCATS Users Course and JCATS Database Course (taught simultaneously)

During week one the JCATS System Administration team (two persons) will be designing custom training materials to match the facility's physical configuration and the site's hardware and network configuration. The team will also setup a classroom server to host JCATS and training aids used during the courses. An automated build procedure of JCATS client workstations using the RHEL Kickstart utility will be designed for the site. The automated build is used to build all JCATS clients to facilitate the rapid rebuild of all JCATS NET clients used for all courses. The RHEL Kickstart rapid rebuild procedure is critical to the JCATS NET to assure all machines are configured correctly after the JCATS System Administration course and the configured properly for use as JCATS User course workstations.

The System Administration team will need access to the site's primary system administrator during the setup week to answer questions about the facility's layout and technical details of the local area network and associated design. No training of students will be performed during the System Administration Course Setup week.

During week two the JCATS System Administration Course will be taught. This course is highly technical, therefore, the requirement for the students to meet all the RHEL prerequisites. It is recommended that only students meeting these prerequisites attend the course. If students attend who do not meet the prerequisites then some training material might be skipped due to the increased time involved in instructing these students. The JCATS System Administrator's Class should be kept to a maximum of five (5) students.

During week three, two different instructors will be teaching the JCATS User and Database courses simultaneously in two different classrooms. One instructor will teach the JCATS Users course in the same classroom the JCATS System Administration course was taught. The other instructor will be teaching a small select group of students the JCATS Database course. Due to the highly interactive nature of the database course it is requested that the class be kept to no more than five (5) students. The JCATS Users course should be kept to maximum of 15 students.

JCATS NET Classroom Requirements

One of the most often over looked requirements is the layout of the NET classrooms. It is imperative that the students be able to look up from their workstation monitors and see the projected computer images and/or PowerPoint slides and follow along with the instructor. The students will be doing this hundreds of times so the classroom (Figure 1) layout below has been found to work best for JCATS NET instruction.

Two classrooms are required to teach the JCATS NET courses. The largest classroom is used for JCATS System Administration (SA) and JCATS User Course training (taught one week apart) and the smaller classroom

is used for JCATS Database training. The number of students for the System Administration and Database classes is limited to 3-5 and 10-15 for the User course.

All the computer workstations and printer are setup in the SA and User course classroom to facilitate debugging. All classrooms are setup during the JCATS NET Setup week. The SA course students will require TWO computers, as they will be building both a JCATS Server and JCATS Client workstations.

The projectors should be positioned on a table to facilitate access to the projector for access to their cables, input ports and to keep the DVI cable lengths at a minimum to avoid syncing and display issues. The Extron video splitter should not be substituted with another brand as we've found other brands to not sync properly with the projector and monitors. High quality Extron DVI cables are also required. During all courses PowerPoint training materials are displayed on one screen (low-res) and the output from the Linux workstation on the other (high-res). The projector closest to the instructors table will be used for Linux projection.

Figure 1: JCATS System Administration Course Layout

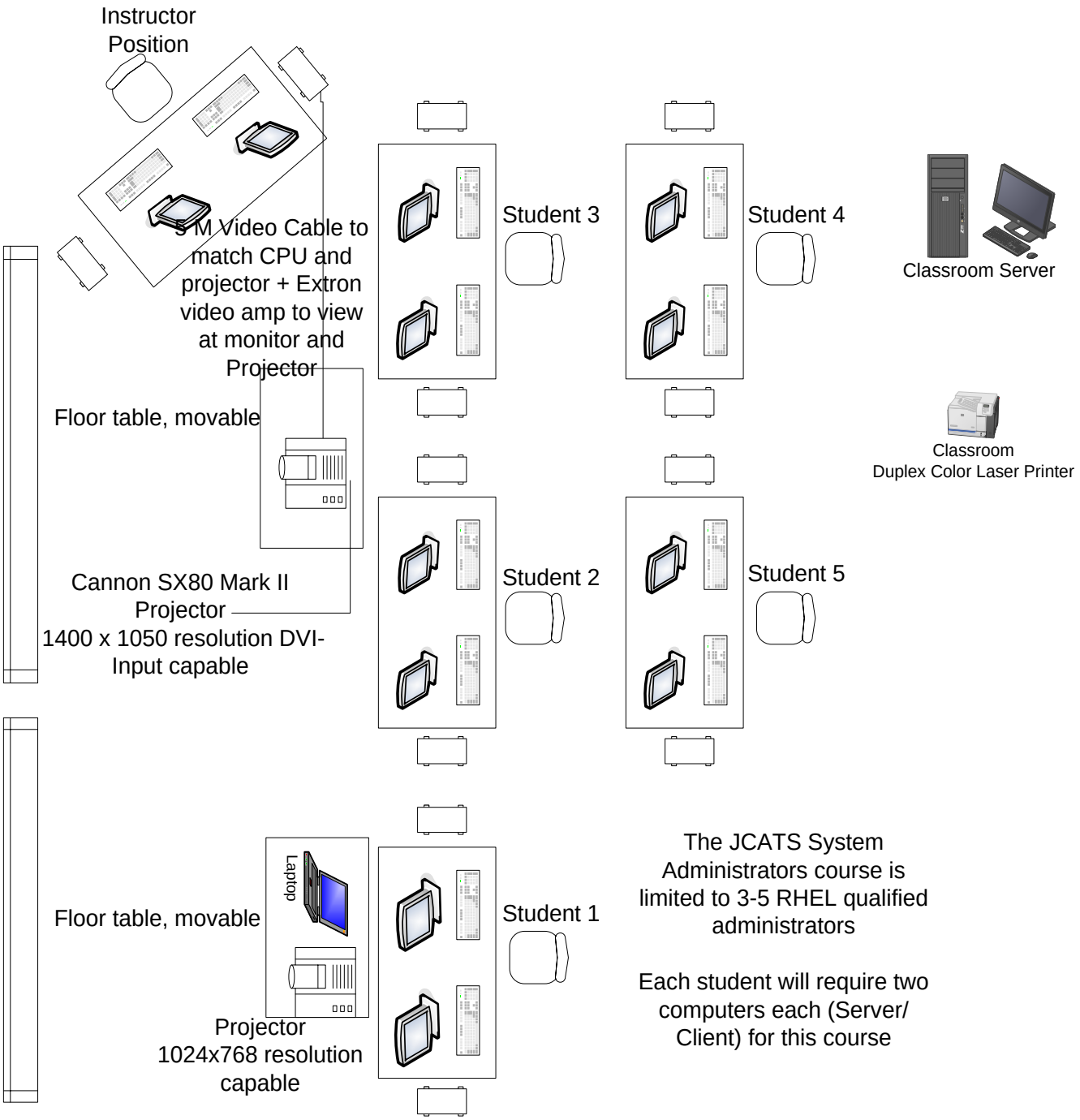
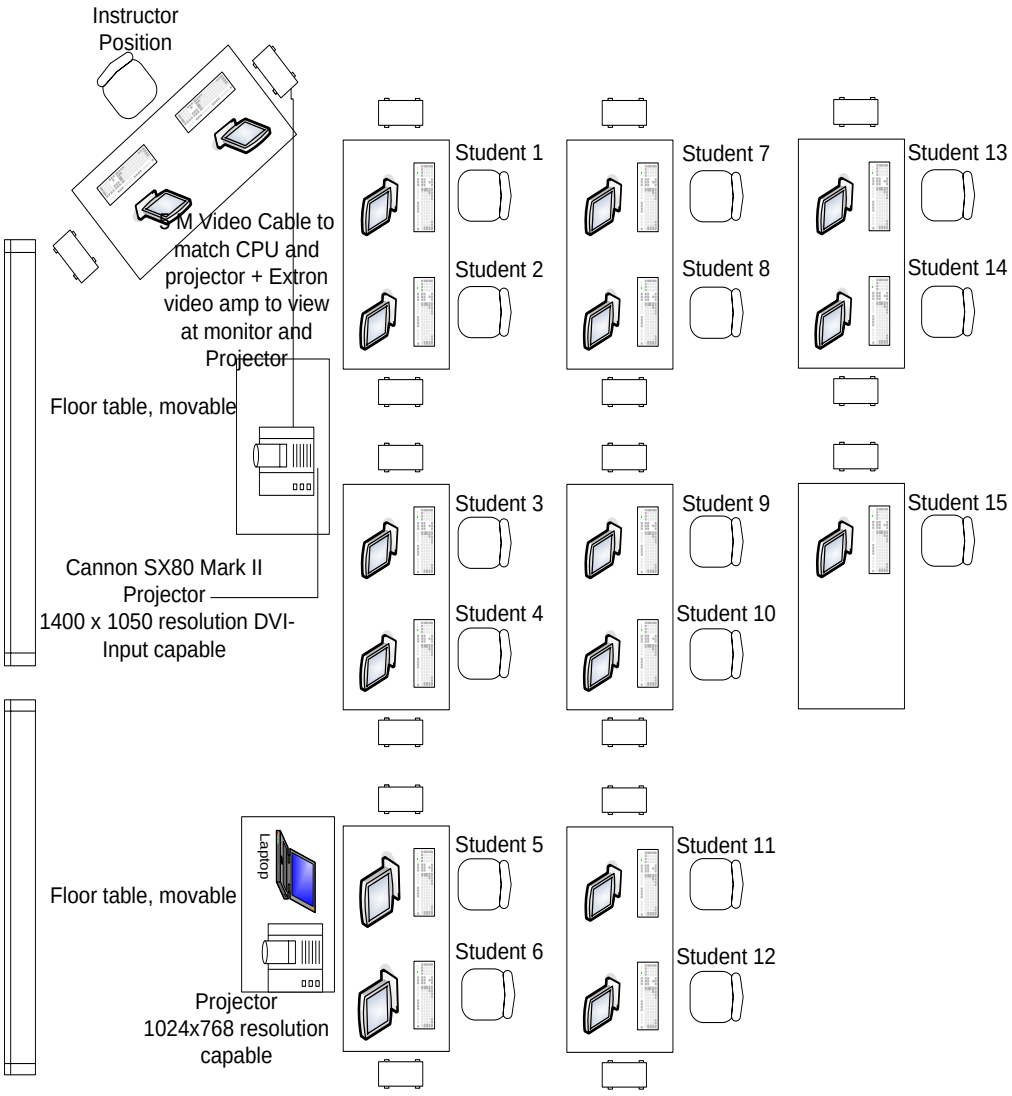
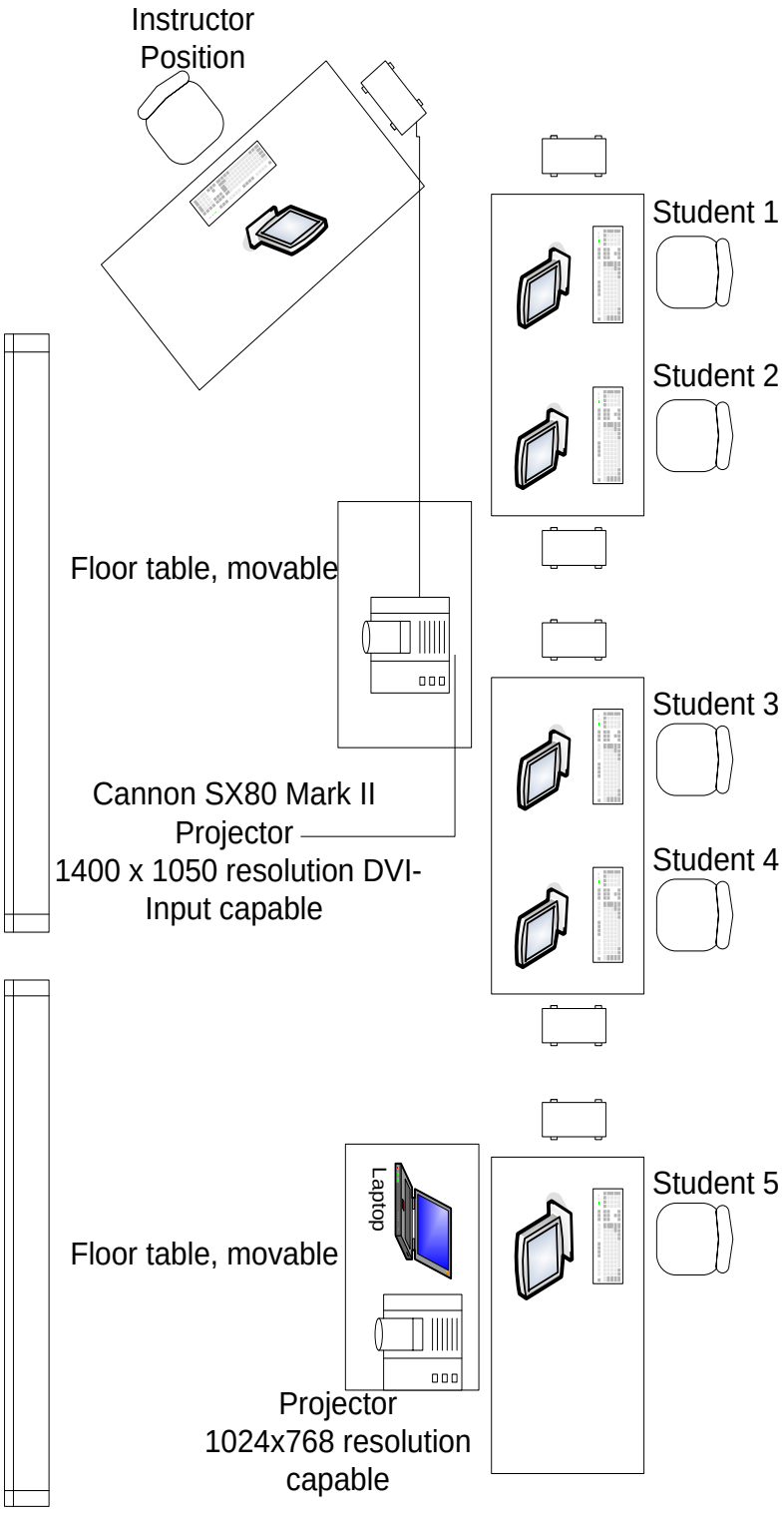


Figure 2: JCATS User Course Classroom Layout



The JCATS User course is limited to 12-15 students

Figure 3: JCATS Database Course Classroom Layout



The JCATS Database course is limited to 3-5 students