# El Dorado County
## Information Technologies

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**STAFF REPORT**

**TO:** Board of Supervisors

**FROM:** David Russell, Assistant Director
Information Technologies Department

**RE:** Virtual Desktop Infrastructure Project

As part of the County's ongoing effort to provide modern, reliable, flexible and sustainable infrastructure, Information Technologies is proposing a project to convert the County's current desktop PC-based infrastructure to a Virtual Desktop Infrastructure (VDI). The Information Technology Steering Committee (ITSC) has reviewed and supports the proposed project.

Currently, the County operates under a "desktop PC client/server" model. Under this model, the majority of employees have individual devices (desktop PCs or laptop computers) that connect to the County's network infrastructure. There are also individual PCs located in a number of conference rooms, shared work stations and reception areas. There are approximately 1700 computers deployed county wide (not including Sheriff Department). All PCs and laptops are managed individually for initial set-up, application updates and support, security updates, patch management, and ongoing hardware maintenance. Employees are generally restricted to performing most of their work on their individually assigned computer. Although it is possible for employees to log in and use other county-owned PCs, not all software applications and files from the employees' assigned computer are available when logged in to other workstations.

Virtual Desktop Infrastructure (VDI) provides a more modern and cost effective alternative to the current desktop PC client/server model. Under this model, a centralized server platform is created to host all components of the current desktop computers (operating systems, software applications and file storage). Individual PCs are eliminated and replaced with "thin client" devices that allow users connect to the server to access their "virtual desktop" that now resides on the centralized server platform. Employees may also connect to their virtual desktops using authorized portable devices such as smart phones and tablets.

ADVANTAGES OF THE VDI MODEL

VDI provides a number of advantages over the current PC based client/server environment:

- Centralized management of desktop infrastructure

- Windows operating system and application security patches and updates are installed and hosted on a central server platform and are available instantly to users
- Better containment of malware attacks, faster incident response
- Significant reduction in equipment costs
- Eliminates need for IT support for employee moves
- Enables employees to work using their complete desktop (files, applications, etc.) at any desk in any county location
- Reduces lost time to near zero for desktop reboots, repairs, and re-builds
- Eliminates risk of data loss due to equipment failure or theft

**Centralization**

All operating system software, application software and security software/processes are centralized, providing a highly flexible and much more secure desktop delivery model managed centrally by Information Technologies staff.

VDI supports a more complete desktop disaster recovery strategy as all components are essentially saved in the data center and backed up through traditional redundant maintenance systems. If a user's device or hardware is lost, the restore is straightforward and simple, because the user's entire desktop environment (files, applications, data) will be present at login from any other device. In addition, because no data is saved to the user's device, if that device is lost, there is zero risk that any critical data can be retrieved and compromised.

**Equipment purchase and replacement requirements**

Desktop PCs:

The IT industry-recommended refresh period for desktop PCs is 3 years. There are many County desktop PCs in service that are well past this recommended lifespan, some as old as 9 or 10 years. There are currently about 705 of our PCs that are at least 3 years old. Maintaining a 3-year refresh cycle would mean replacing those 705 PCs in FY 2016-17. This cost would be approximately $521,000 ($740 per PC).

In FY 2017-18, 232 PCs will be older than 3 years, with replacement costs of $172,000. Approximately 377 PCs will age-out in FY 2018-19 at a cost of about $279,000. In FY 2019-20, there will be about 150 PCs that are new as of today, but will be past their lifespan. The 705 workstations bought in FY 2016-17 will also reach end-of-life, for a total of 855 PCs to be replaced at a cost of $633,000. The costs will continue to cycle in approximately these same amounts in years beyond FY 2019-20. If we continue to replace computers as industry standard suggests, between FY 2016-17 and 2019-20, the County would need to replace approximately 2169 computers at $1.6 million.

Additionally, PCs are complex pieces of hardware. Supporting 1,700 machines means a constant need for parts refresh and replacement (disk drives, power supplies, video cards, and,

at times, the entire PC). A significant number of current deployed workstations are past warranty expiration, which means dispatching parts can be time-consuming and complicated. In some cases, it is easier to buy a new PC.

VDI:
Thin client devices replace desktop PCs and are about the size of a paperback. Thin client devices have no moving parts resulting in no associated parts costs. The lifespan of the VDI thin client device is 10 years, at a unit cost of approximately $300. The VDI project will replace aging PCs at the rate of 400 per year (up to 600 in the first year), which will almost completely eliminate the cost of PC purchases by departments. *(Note: It is not possible to eliminate all physical PCs. Some requirements exist that require specialized hardware that cannot be virtualized, and in some cases regulations may mandate physical machines, such as Elections ballot system.)*

The out-year spending on VDI thin clients (vs. PCs) is approximated below:

| Client Equipment | FY 16-17 | FY 17-18 | FY 18-19 | FY 19-20 |
|---|---|---|---|---|
| PCs (3 year lifespan) | $521,000 | $172,000 | $279,000 | $633,000† |
| VDI Thin Client (10 year lifespan) | $180,000‡ | $120,000 | $120,000 | $0 |

† Cost cycle approximately repeats in following years.
‡ Includes the 200 thin clients purchased in FY 2015-16 for Building A/B project.

**Desktop support requirements (hardware, software, staff)**

Desktop PCs:
The IT Department currently has 7 Desktop Support technicians responsible for supporting more than 1,700 employees/computers. This ratio (243:1) is about 3 times higher than recognized IT standards of 75-100 workstations per technician. Operating system and application software management is automated to the best degree possible, but often requires downtime and technical assistance any time there are updates, additions, or changes required to user's workstations. IT technicians are often required on-site to support employee moves, installations, and in some cases merely for troubleshooting problems.

Malware attacks require affected machines to be re-imaged. This process usually takes a minimum of 3 hours, during which time the employee is unable to work, and the IT staff is tied up with the re-image process. Since January, we have lost more than 240 hours of productivity (combined IT staff and affected employee hours) due to malware. This equates to about 0.5 FTE per week for both IT and the affected department.

VDI:
Support staffing requirements for VDI are significantly different from traditional client/server environments. Industry guidelines indicate that a single technician can support up to 1,000 virtual desktops. Given current staffing levels, this would enable the IT department to re-deploy and re-train several technicians to support other projects and department needs. Virtual workstations are managed from a central console. Applications can be installed or updated, OS patches can be deployed, malware can be cleaned and workstations can be rebooted with the click of a button; quite literally in a matter of seconds.

The estimated resource impact on the IT Department for ongoing malware detection, triage, and remediation process in our current environment is consuming up to 50% of 1.0 FTE. VDI will reduce the impact of malware by hugely decreasing remediation time from as much as 3-5 hours to literally seconds. VDI will enable the County to gain back many lost hours of productivity across all affected departments.

**Coordination with Building A/B Renovation Project**

Conversion to VDI this spring will allow the use of thin client devices in the "swing space" with employees remaining on thin clients when they return to their offices after renovations are complete. There will be no need to move desktop PCs in/out of the swing space between renovation phases. This will have three key benefits:

1. Physically moving PCs–especially older ones–will inevitably result in hardware failures. Disk drives, power supplies, and other components are prone to failure when physically handled, powered off, re-cabled, powered-on, etc. Also, each PC would have to be reconfigured for new printers and peripherals in the swing space, increasing the potential for problems and down-time. Implementing VDI will avoid these monetary and time costs.
2. There is a positive impact on the renovation project schedule by not having to move equipment in/out between phases, saving as much as several weeks over the full timeline of the project.
3. Conversion to VDI will enable IT to redeploy newer PCs recovered from renovated spaces, thus improving technology refresh for Departments outside of Buildings A & B. Eventually, county workstations will be converted to VDI, but in the interim, departments still using physical PCs will be able to refresh their older machines with those recovered from departments already converted.

The physical move sequence for employees affected by the Building A/B renovation project will be as follows:

- Employees will move into swing space per the project plan, but their PCs will not be moved to the swing space. Employees will be moved to swing space desks equipped with the thin client devices, where their desktop files and applications will be presented and accessible via VDI.

- The desktop PCs from each move-in phase will be evaluated and either marked for surplus (if older than 3 years) or (if less than 3 years old) retained for potential redeployment to replace older machines in other departments.

- At the end of the renovation phase, employees who have been working on VDI in the swing space will be moved back to their renovated offices and continue using VDI on thin clients that will be installed after renovation.

**Future Move Coordination Efforts**

Once VDI has been deployed in all office spaces, there will no longer be a need for IT support for future physical moves of staff. With VDI, the employee's desktop environment (including applications, data, shared drive mapping, and local files) will "follow" them to whichever VDI device they log onto. In fact, even open and running applications will be "moved" to whichever VDI workstation the user physically moves to. Employees will access their own complete desktop environment from any VDI workstation, regardless of physical location. This applies to conference room computers and "shared use" machines at front desks or interview rooms. Employees using these machines will be presented with their own desktops regardless of where they are working. This also applies between buildings and sites, so employees who regularly work in Placerville will have their full desktops available if they have to travel to SLT, and vice versa.

**Security**

Desktop PCs:
It can be argued that the most valuable asset of the county (second only to our employees) is our data. Our data is fundamental to our ability to provide vital public services. Every bit of data we store or process–from public meeting minutes to sensitive law enforcement information–must be protected from misuse, destruction, and unauthorized access. Unfortunately, laptops and desktop PCs can be compromised with malicious software or physically damaged or stolen. With our current client-server architecture, county data resides on our workstations, making it vulnerable to loss or corruption.

VDI:
With VDI, all data and applications stay safely inside the IT data center. The thin client device is really only presenting the employee with a "picture" of a workstation screen, and allows them to interact with the data and applications via a keyboard and mouse. Theft is not a risk, since no data ever resides on the thin client device. In the event of a malicious software attack, the virtual workstation can be stopped, rebuilt, and restarted in less time than it takes to log in to a traditional workstation.

**Environmental impacts - energy usage and e-waste generated**

Desktop PCs:
A typical PC uses 150 Watts of energy in normal operation. Assuming all county workstations are used for only 8 hours per day and shut off during non-working hours (which they are not), the County consumes more than half a million kilowatt-hours per year just to run its PCs.

IT standard practices recommend a useful lifespan of a desktop workstation of about 3 years. After that time, the risk of sudden disk failure or other hardware issues begin to increase rapidly. Also, applications and productivity demands three years from now will probably be beyond the capability of a PC purchased today. If a refresh schedule is maintained, the county would be disposing of at least 200 to 300 PCs every year.

VDI:
The thin client devices s use less than 9 Watts of energy. The County's power consumption will be less than 1/10th of what is currently used for traditional PCs. Since the county will be buying only one small device every 10 years, as opposed to a full-sized PC every three years, our environmental and e-waste footprint will be much smaller.

**Other Considerations**

In a VDI environment, an employee can connect to their complete "workspace" from any location in a secure, device agnostic manner. There are VDI tools that will even allow employees to access their full desktop on mobile devices, such as iPads and smartphones.

VDI is in wide use throughout public sector agencies, medical facilities, and private enterprises. Local entities that use VDI include Marshall Hospital and EID. It is also widely used by schools and universities. Other counties using VDI include Yolo County HHSA and Emergency Services and San Mateo Health & Human Services Agency.

VDI PROJECT PLAN

Phase I – Build core VDI infrastructure and convert 200 users – April 2016 thru June 2017
Phase II – Convert additional 400 users – FY 2016-17
Phase III – Convert additional 400 users – FY 2017-18
Phase IV – Convert additional 400 users – FY 2018-19

Conversion to VDI is projected to take 3 years and begins with development of the centralized server platform which includes purchasing and configuring servers that will reside in the County's data center.

Conversion of individual desktop PCs will begin with the Building A/B renovation project in June 2016. IT will install VDI thin clients in the "swing space" buildings, and virtualize each of the affected department's desktops as employees move into the swing space. At the end of each renovation phase, IT will have thin clients installed in each of the offices in Buildings A and B, and employees will move seamlessly into their previous locations. The employee's new

virtual desktop will “follow” them to wherever they log in. Over the course of the 4 phases of the Building A/B renovation project, IT will have virtualized all 200 employee workstations in those buildings.

In FY 2016-17, IT will also begin deploying the VDI solution to employees in other departments. The plan is to deploy 400 VDI thin clients per year over three years so that conversion of desktop PCs would be complete in FY 2018-19. The first deployment of 400 will overlap with the Building A/B renovation project, so there will be as many as 600 virtual desktops in the first year of the VDI project.

It should be noted that not all current PC devices will be converted to VDI. There are certain special cases that are not suited for virtualization. For example, employees who work in remote locations without internet connectivity (such as emergency responders during disaster operations), or employees who work in the field serving remote communities, will retain laptops or tablet devices. IT will work with each department to identify specific needs.

VDI PROJECT COSTS & COST SAVINGS

Information Technologies staff worked with one of the largest global virtualization software solution providers to perform a detailed Return on Investment (ROI) analysis. The results of that analysis are summarized below:

| **Investment** | **Amount over 5 Years** |
|---|---|
| Hardware (servers, switches, client devices) | $630,676 |
| Software Licenses (OS and Application management) | 1,668,425 |
| Implementation Services | 60,000 |
| **Total** | **$2,359,101** |
| | |
| **Savings** | |
| Clients/Devices (not buying PCs) | $1,620,700 |
| Operational Expenses (hardware support/deployment time) | 1,242,370 |
| User Productivity (reduce downtime, more efficient) | 399,155 |
| Power and Cooling (utility costs) | 88,838 |
| Cost Avoidance (PC warranty cost, workstation mgmt tools) | 256,000 |
| **Total** | **$3,605,064** |
| | |
| **Total Net Savings over 5 Years** | **$1,245,963** |

Significant savings also projected for years 6-10. No thin client hardware refresh required until at least 2026.

**Financial Impact**

Total estimated costs for the project are $2,379,500 and would be paid during four fiscal years, beginning in FY 2015-16 with a 3 year implementation process, as follows:

| | |
|---|---|
| Initial hardware and software purchase in FY 2015-16 | $440,000 |
| Year 1 hardware and software | 677,500 |
| Year 2 hardware and software | 664,000 |
| Year 3 hardware and software | 598,000 |
| **Total** | **$2,379,500** |

Initial purchases in FY 2015-16 include:

| | |
|---|---|
| Blade Server | $117,500 |
| Server Rack | 4,300 |
| Disk Storage Array | 51,700 |
| Client devices | 54,000 |
| Virtual Workstation Software | 107,500 |
| Microsoft Licenses | 62,500 |
| Implementation Services | 42,500 |
| **Total** | **$440,000** |

Funding for the initial hardware and software purchase is available from savings within the FY 2015-16 budget for Information Technologies, primarily as a result of salary savings from vacant positions. Funding for future year costs would be included in the Information Technologies budget and will be offset by reductions in PC equipment purchases in other County departments and later recovered through the A-87 cost allocation plan charges to departments.

**Recommendation**

Information Technologies is recommending the Board:

1) Receive a presentation on a project to convert the County's desktop PC-based infrastructure to a Virtual Desktop Infrastructure (VDI);
2) Approve the project and three-year implementation plan;
3) Waive competitive bidding requirements pursuant to County ordinance 3.12.030 section D allowing Information Technologies to use an existing competitively bid contract for the purchase of all required software, hardware and services necessary to implement the project;
4) Authorize the Purchasing Agent to execute purchase orders and contracts for the necessary software, hardware and services required in FY 2015-16 (estimated at $440,000, including fixed assets estimated at $169,200), subject to review and approval by County Counsel and Risk Management as required; and
5) Direct the Chief Administrative Office to develop and issue guidelines for the Fiscal Year 2016-17 Budget and beyond to ensure that any traditional desktop PC-based equipment purchases are centralized through IT to the greatest extent possible while maximizing the recovery of costs from non-General Fund sources.

*"The commitment of the Information Technologies staff is to deliver creative, practical solutions and services in support of the current and future technological needs of El Dorado County."*