Voting System Anomaly Root Cause Analysis Template v2.0

Root Cause Analysis for:

**VV40ECT-87: VxMark Unable to Save CDF Logs Due to Time Limit - Rev. 1
VxSuite, Version 4.0 and EAC Certification #VXS4**

**VotingWorks
548 Market St, Ste 53001
San Francisco, CA 94104-5401**

May 21, 2025

Contents

Introduction

This RCA documents the investigation into VxMark exhibiting an anomaly of not exporting CDF logs due to a 30-minute session timeout limit. The session timeout is important for security reasons, and at the same time the slower CDF export feature is important for providing users an alternative option for saving data. This investigation would help resolve this conflict.

Anomaly Description

Complete all sections. Descriptions must be as detailed as possible, while being clear and concise since the anomaly is the source of the entire RCA. This detail should include a complete list and/or description of the "symptoms" of the anomaly and the conditions present which the symptoms occurred.

Date of Anomaly: March 24, 2025	Time of Anomaly: 8:49am
Place of Anomaly: SLI, Wheat Ridge, CO	Person identifying Anomaly: Lekshmi Nath, SLI Compliance Jessica Myers, VotingWorks
Expected Results of actions leading up to anomaly: In VxMark, saving logs in CDF format should take place without issue, even for large logs.	
Detailed description of the event / anomaly: After multiple days of using VxMark, when attempting to save as CDF log format, the 30 minute session timeout limit kicks in before the logs are saved. The logs are not saved to the USB.	

If the anomaly is repeatable, provide step by step instructions to recreate it:

These steps to recreate the issue assume the VxMark software has not been updated, using an old software version before v4.0.2:
- Run the VxMark machine, and keep on for multiple days of use without turning off.
- Then attempt to save CDF logs. Insert an election manager or system administrator card and log in. Insert a USB drive. Select "Save Logs" and choose the CDF format.
- Wait up to 30 minutes for the notification of a timeout. Check the USB contents for the presence of the saved logs.

Chronology of Events / Timeline

Provide a detailed chronology of the events leading up to, and following, the anomaly. Add additional events if necessary.

ID	Date/Time	Description	Entity Org/person	Result / Notes
1	March 24, 2025, 8:49am	Anomaly is reported to VotingWorks by SLI testers.	Jessica Myers, VotingWorks	Details are shared with the wider VotingWorks team.
2	April 1, 2025	First attempts to reproduce the issue were made.	Arsalan Sufi, Matt Roe, VotingWorks	CDF log exports were expected to take notably longer than standard exports. Plans were made to investigate large CDF exports and how to handle them to avoid the anomaly.
3	April 21, 2025	VxMark code was modified to speed up CDF log exports.	Kofi Ohene-Adu, VotingWorks	Support was added for faster handling and conversion of data to CDF format using Rust-based utility, as detailed in a series of pull requests linked in the GitHub issue linked here.
4				
5				

Investigative Team and Method

This section shall describe how the investigative team is assembled by the voting system manufacturer, who it consists of, and how it gathers the data to be used in the analysis. Include the RCA method employed by the manufacturer in conducting the analysis and why this method was used.

Names and Positions of members of the investigation team:
Jessica Myers, Head of Compliance
Arsalan Sufi, Head of Software
Matt Roe, Head of Product
Kofi Ohene-Adu, Software Engineer
Describe the data gathering process: After initial reporting of the anomaly to Jessica Myers, the issue was shared with the wider VotingWorks team. Arsalan Sufi and Matt Roe joined the investigation to attempt to reproduce the issue, identifying a root cause related to slower software handling of CDF format exports. They planned mitigation strategies, while engineer Kofi Ohene-Adu implemented the planned solution, modifying the existing VxMark software to speed up data conversion to CDF.

Describe which methodology(s) is used to conduct the root cause analysis:

This investigation relied on the "5 Why's" strategy, starting with asking why the time limit would be reached during exports. Early answers narrowed down the explanation to software issues, because the extended export times were caused by slow conversion and handling of CDF data compared to the standard export format. Further questioning by VotingWorks software engineers then led to deeper analysis of the conversion libraries and methods in software. Solutions then could focus on updating the libraries and conversion logic as needed.

Findings and Root Cause

Describe the findings of the investigation and explain the root cause(s) based on these findings. If the RCA results in findings that are not directly related to the root cause of the anomaly, these should also be captured as manufacturer product/process improvement steps in an effort to improve the voting system.

VotingWorks machines store logs in VotingWorks format rather than CDF format. To support CDF-format log exports, VotingWorks machines convert the stored VotingWorks-format logs into CDF-format logs. The existing conversion logic used in the VxMark unit in this anomaly is written in TypeScript and uses a popular schema validation library that is slow, especially when log files are large. This slow conversion logic is why SLI's VxMark CDF-format log exports were not finishing before the inactive session time limit.

Corrective Action(s)

To address the slow CDF export, VotingWorks has rewritten the data log conversion logic. The new conversion logic is written in Rust rather than Typescript and is much faster, roughly 40 times as fast in our internal tests. This updated logic will be delivered to SLI as part of the v4.0.2 release.

Solution Management

The purpose of this section is to manage the corrective action(s) moving forward. This should detail all process changes to manage those corrective actions, and steps taken to ensure the actions eliminate the anomaly over time.

The software updates to the CDF conversion logic have been integrated into the v4.0.2 release, to be shared with SLI. Standard quality assurance and testing procedures will verify again that large log exports will not trigger the timeout.