Adopting a Universal File Format for the Nondestructive Testing and Examination Industry

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Abstract

The NDT industry's transition to NDE 4.0 promises enhanced efficiency through digitalization, but it faces a significant bottleneck— the numerous incompatible file formats used by our equipment manufacturers. This article advocates the adoption of a universal open file format, namely, the .nde format. Utilizing HDF5 hardware description language, the .nde open file format offers increased data compatibility, accessibility, and archiving benefits, while its use of the JSON structure simplifies file management. In contrast to DICONDE, .nde proves flexible enough to generate DICONDE files, offering greater versatility.

The use of the open HDF5 language enables easy data viewing through multiple API options, facilitating customization to meet specific needs. Importantly, the .nde file format's autonomy from proprietary software enables independent auditors and regulators to use custom software for unbiased data validation.

The adoption of a universal open file format unlocks numerous possibilities for the NDT industry, including integration into digital twining and inspection data management systems, fostering cooperation and knowledge sharing. It also empowers the industry to harness the potential of artificial intelligence (AI). By standardizing data formats, collaborative AI development and data sharing among equipment manufacturers become feasible, making the AI integration process more efficient.

While the vision of industry-wide collaboration may seem ambitious, this article contends that the adoption of the .nde open file format is the logical next step in the industry's digitalization journey. Uniting key players to make all equipment compatible with .nde holds the promise of unleashing the industry's true potential and accelerating progress in the era of NDE 4.0.

1 INTRODUCTION

The NDT industry's constant quest for improved efficiency and our pursuit of the promises of NDE 4.0 are converging at a critical juncture. Our progress towards digitalization is being stunted, compared with other scientific industries, by our individualistic development model, which is epitomized by a prevalence of incompatible file formats. Pioneering the path forward necessitates an examination of the option to adopt a universal open file format, a measure enacted by other industries with desirable results. In this case, we'll present and scrutinize the potential of an open file format already in existence, namely the .nde format. Founded on the robust HDF5 architecture and utilizing JSON archiving, this technological amalgamation proposes a novel dimension of data accessibility, preservation, and interoperability, desirable aspects that should compel industry stakeholders to consider its implementation.

2 NDE UNIVERSAL OPEN FILE FORMAT, A PANACEA FOR STUNTED PROGRESS

Throughout decades of NDT technological evolution, we've witnessed a proliferation of proprietary software, typically accompanied by a distinct and proprietary file format. Even within one manufacturer's product line, file format variation has

been known to occur. The repercussions of this widespread incompatibility resonate throughout the industry, creating frustrating hurdles that prevent or complicate data sharing between collaborators, auditors, and experts. This discrepancy also hinders customization, particularly when dealing with diverse inspection technologies and instruments. The consequence is a fragmented NDT landscape that demands a unifying solution.

As an open file format, .nde offers a remedy that can satisfy the needs of all stakeholders. Constructed on a base of HDF5, a durable and accepted archiving solution, .nde transcends file size limitations and fosters data management, storage, and retrieval efficacy. Furthermore, the format's flexibility ensures that data accessibility is not confined to proprietary software. Since it's not proprietary and can be read without a proprietary application programming interface (API), the .nde file format could be universal in its compatibility, agnostic to equipment origin, and adaptable to user needs. However, this universality is dependent upon its acceptance and wide implementation within the industry.

3   KEY ADVANTAGES OF THE NDE (.NDE) OPEN FILE FORMAT

The .nde format's use of the HDF5 architecture translates into robust compatibility across diverse computational platforms and programming languages, helping ensure its longevity. A notable benchmark of its acceptance, the HDF5 format has been integrated into numerous projects undertaken by the National Institute of Standards and Technology (NIST), a key industry standard authority. In a similar vein, the .nde format's use of

JSON to embed file parameters not only enhances its file management efficiency, but also aligns it with U.S. National Archives and Records Administration (NARA)'s accepted standards.

Another contender, established NDT archiving and imaging standard DICONDE, has proven sufficient for simpler data. However, DICONDE format lacks robustness when faced with the complex data acquired and recorded by methods such as ultrasonic testing (UT) or eddy current testing (ECT). The .nde format rises to the occasion by accommodating diverse and intricate NDT data requirements, underscoring its adaptability.

Being HDF5-based, the .nde format offers an array of customizable options for data visualization, either using official open-source APIs or various user-interface alternatives that can be tailored to specific requirements. Of particular significance is the absence of proprietary software, which empowers independent auditors and regulators to employ custom solutions for objective data validation, fostering impartial review processes.

The integration of a universal open file format into the NDT community has the potential to usher in a new era of cooperation and innovation. Beyond overcoming interoperability challenges, .nde proposes a future where conventions, references, and code snippets are readily shared among stakeholders. Furthermore, the stage is set for the infusion of artificial intelligence (AI) into NDT practices, with a standardized data format simplifying data sharing and accelerating the development of AI-driven solutions.

4   CONCLUSION

The NDT industry is poised for a major leap forward in our digital transformation through the adoption of the .nde open file format as a universal file format. This endeavor necessitates industry-wide alignment, wherein all key players commit to enabling their equipment for .nde compatibility. The parallel of other industries that have standardized their file formats underscores the urgency and rationale behind this pivotal evolution. By casting off the shackles of file format incompatibility, the NDT

industry stands to unlock its full potential, accelerating progress in the era of NDE 4.0.

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