



INFORMATION STORAGE INDUSTRY CONSORTIUM

International Magnetic Tape Storage Roadmap

December 2015

TABLE OF CONTENTS

- INTRODUCTION.....1
- REFERENCES.....2

- 1 APPLICATIONS AND SYSTEMS.....5
 - 1.0 PARTICIPANTS5
 - 1.1 EXECUTIVE SUMMARY5
 - 1.2 MARKET TRENDS6
 - 1.3 TECHNOLOGY TRENDS.....9
 - 1.4 TAPE’S COST AND ENERGY CONSUMPTION ADVANTAGES...14
 - 1.5 THROUGHPUT AND RELIABILITY.....19
 - 1.6 CHALLENGES FOR TAPE ADOPTION.....25
 - 1.7 INDUSTRY USE CASES FOR TAPE.....26
 - 1.8 INDUSTRIES WHERE TAPE IS USED.....35
 - 1.9 CONCLUSIONS AND RECOMMENDATIONS.....39
 - 1.10 ACKNOWLEDGEMENTS.....41
 - 1.11 REFERENCES.....41

- 2 TECHNOLOGY.....46
 - 2.1 INTRODUCTION.....46
 - 2.2 ROADMAP DISCUSSION.....49
 - 2.3 KEY TECHNOLOGY TRENDS.....52
 - 2.4 SUMMARY AND CONCLUSIONS.....64
 - 2.5 ACKNOWLEDGEMENTS.....65
 - 2.6 REFERENCES.....66

INTRODUCTION (this section is heavily leveraged from a previous INSIC roadmap [1])

This document presents a ten-year outlook for the future applications for information storage that may be handled by advanced magnetic tape storage systems, along with an in-depth analysis of the technologies that will be required to make those systems possible through 2025. It is an update to the International Magnetic Tape Storage Roadmap produced by the Information Storage Consortium three years ago [2], and represents INSIC's 7th magnetic tape storage roadmap, with previous studies having been published in May 2012, September 2008, April 2005, February 2002, June 1998, and September 1994, the earliest three of these roadmaps having been published as the National Storage Industry Consortium (NSIC). The view contained here or technology advances projected for future tape drives and media is a remarkable testament to the successful longevity of the oldest computer storage technology still in use today, nearing its 64th anniversary [3].

We believe that two conclusions stand out from this Roadmap. First (Taken from this document's Systems and Applications Executive Summary): *"The inherent, fundamental advantages of tape are its low acquisition cost, extremely low power consumption and cooling requirements, excellent footprint, scalability and of course, reliability. Other attributes that can be significant are tape's offline data protection and portability. Tape's future is driven by the needs of multiple markets and use cases for these attributes. In short, tape is best for applications that do not require fast access, so basically the opposite end of the spectrum of flash applications.*

Tape's role in data protection has shifted to become the disaster recovery tier; a key technology used by Cloud Service Providers for backup as well as long-term backups kept for compliance and archive purposes. Tape has significant cost advantages over purpose-built backup appliances for data that cannot be de-duplicated very well, such as data that is compressed (e.g., video), or data that is encrypted."

Second, tape technology and products have continued to deliver on the promise of earlier INSIC roadmaps by doubling capacity approximately every two years. The present roadmap draws heavily from the 2012 roadmap and calls for a continuation of this rate of progress for at least the next decade. Technology proofs exist to support this progress and highlight that Tape has another decade of "clever engineering" to achieve these goals. (Taken from this document's Technical Roadmap Summary): *"Looking to the future, there is considerable uncertainty regarding future scaling rates of HDD due to the challenges associated with overcoming the super-paramagnetic effect and the uncertainty over the timing and the eventual success of the introduction of new technologies needed to continue HDD scaling. In contrast, state of the art tape drives operate at areal densities that are more than two orders of magnitude smaller than the latest HDDs. It should therefore be possible to continue scaling tape technology at historical rates for at least the next decade, before tape begins to face similar challenges related to the super-paramagnetic effect."*

INSIC gratefully acknowledges the leadership contributions of the participants listed in each section, without whom this document would not have been possible, as well as the contribution of all of the roadmap study participants. We believe that, thanks to the

contributions of these experts, the report is balanced and credible, and that it delivers an optimistic outlook for tape storage going forward.

We hope you find INSIC's 2015-2025 International Magnetic Tape Storage Roadmap that follows to be both enlightening and worthwhile.

REFERENCES

1. International Magnetic Tape Storage Roadmap, Information Storage Industry Consortium, May 2012. Introduction written by Paul D. Frank & Barry H. Schechtman.
2. International Magnetic Tape Storage Roadmap, Information Storage Industry Consortium, May 2012
3. Mearian, L., "As 60th Anniversary Nears, Tape Reinvents Itself, " Computerworld, March 29, 2012. Available online at:
4. http://www.computerworld.com/s/article/print/9225514/As_60th_anniversary_nears_tape_reinvents_itself . Accessed May 2012