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THIC Inc.

The Premier Advanced Recording Technology Forum

ML™ Technology:

The Future of Optical Disc Recording

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CALIMETRICS

Calimetrics, Inc.

- **Inventor and Owner of ML™ Technology**
  - Triples Capacity and Speed of CD-RW
  - Doubles Capacity and Speed of Recordable DVD and Blue Laser Systems
  - Provides Tamper Proof Digital Rights Management and Security Features
  - Proprietary Technology: over 70 Patents & Patents Pending
  - Founded in 1994 and Headquartered in Alameda, CA
  - CEO is Ken Campbell (ex-Conner, Archive, Xerox); 24 staff; 10 PhDs
- **ML Technology's Key Features/Benefits**
  - Delivers More ***Secure*** GBs to the Customer Faster and for Less Money
  - Compatible With CD, DVD, Blue Lasers, and Industry Infrastructure
- **Calimetrics' Mission**

  "To Enable Faster-Bigger-Cheaper Digital Data Storage and Transmission for Legacy Systems Using ML and Related Technologies"

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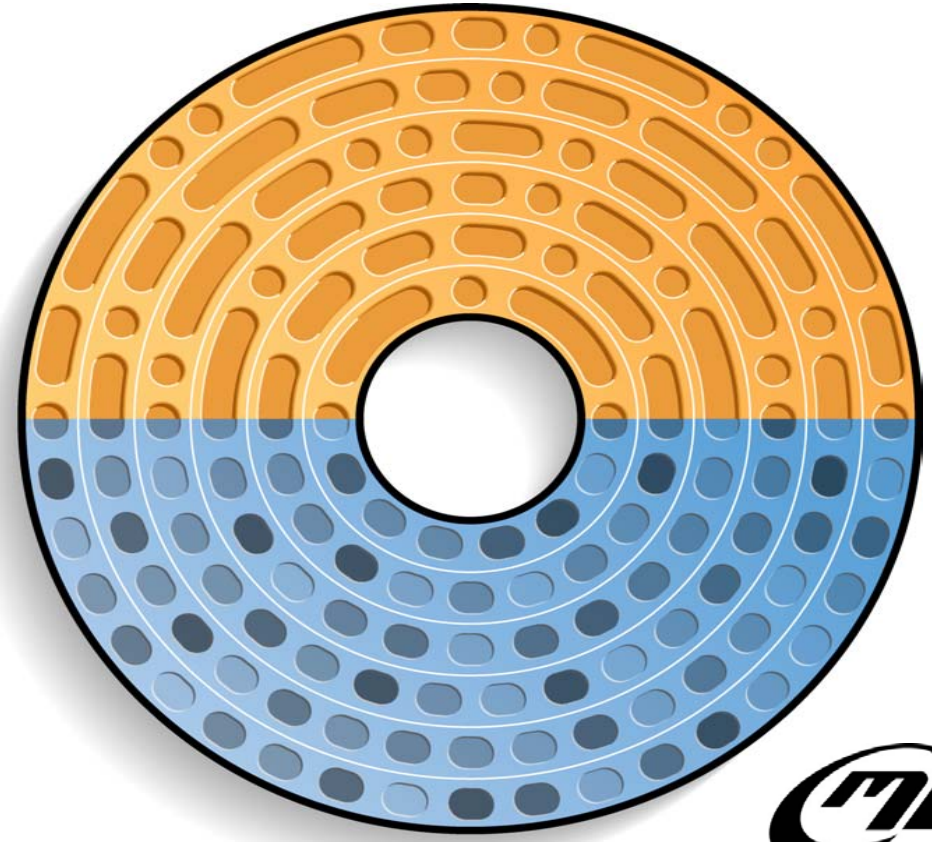
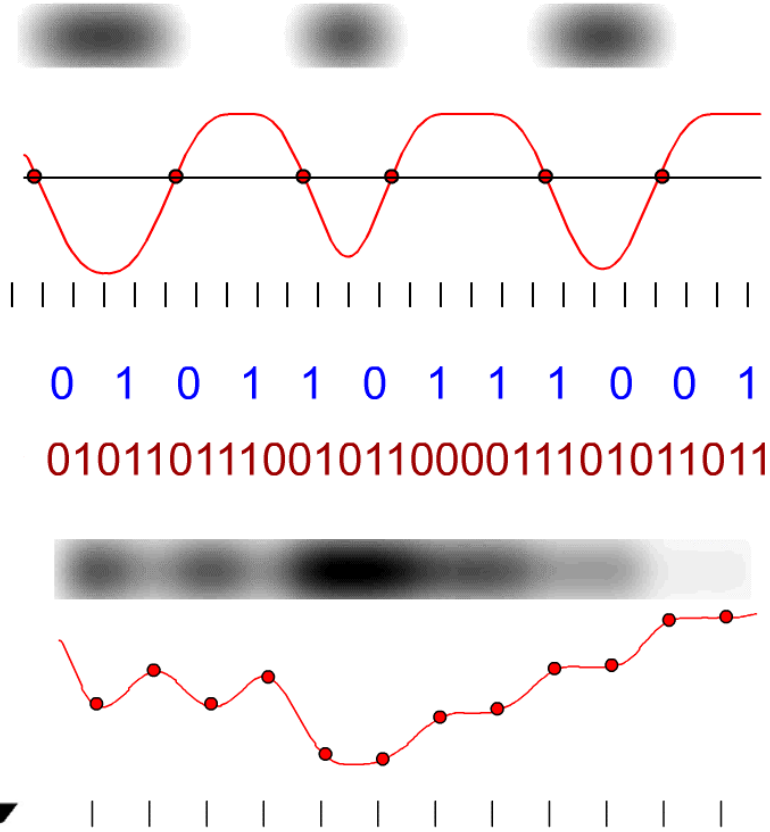
ML™ Technology





Multi Level

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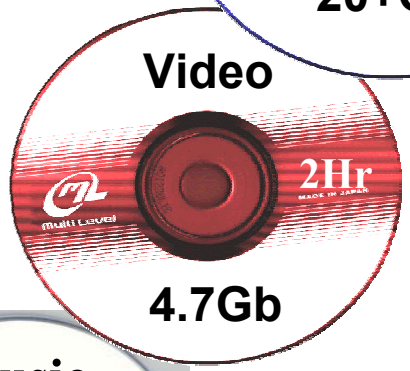
Industry Drivers

12 Exabytes and Doubling

80% Created Digitally

Text in Kbytes
Music in Mbytes
Video in Gbytes

Worlds Data



As Customer Demands Richer Content => Capacity Is King

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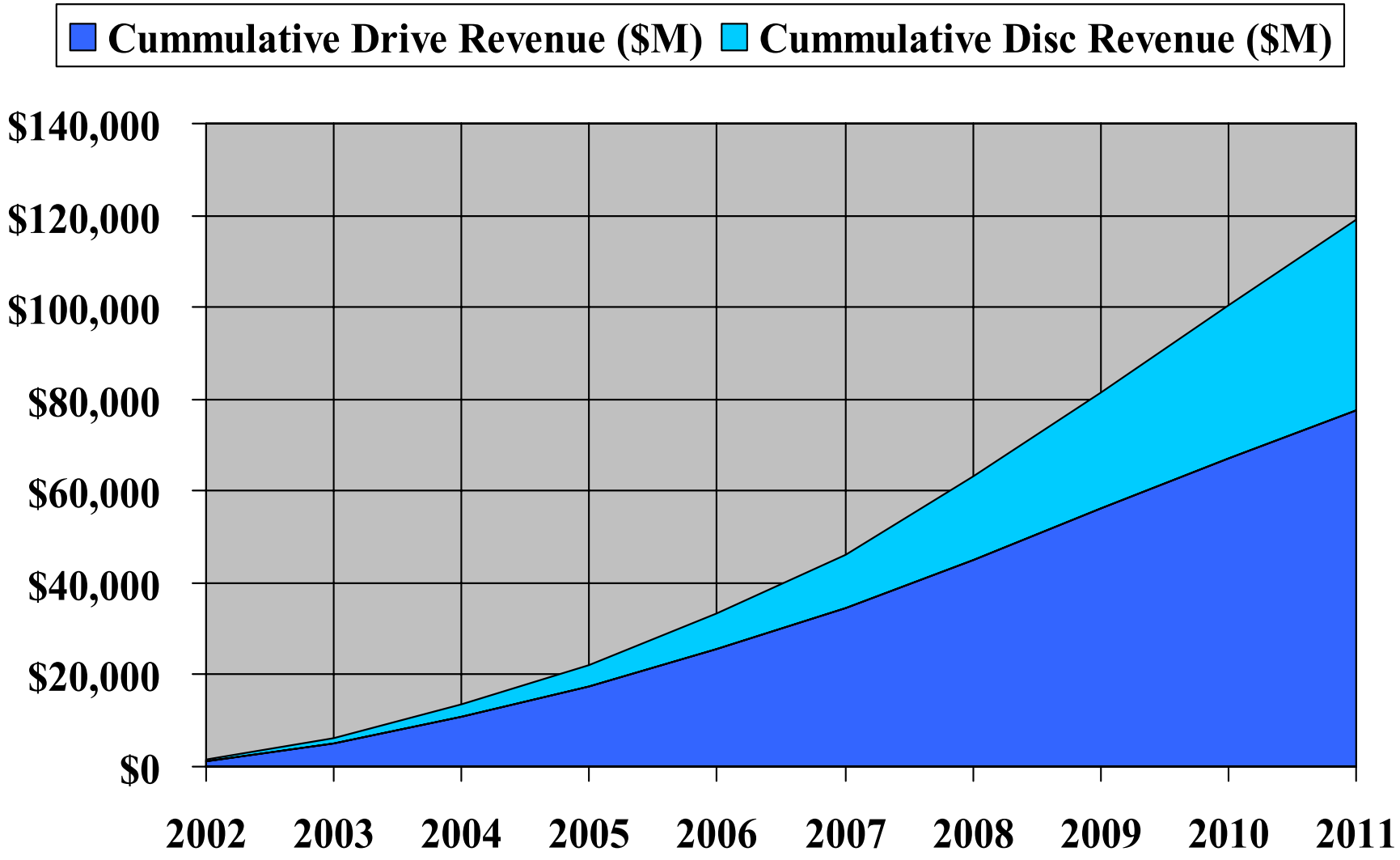
The Total DVD Opportunity



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Capacity Demand

1. **DRIVEN BY Screen Size / Resolution**
2. **DRIVEN BY 6 Hour Recording Feature**

VHS

6 Hours = 1 Tape

DVD

6 Hours = 7GB Min.

HD DVD

6 Hours = 25GB Min.

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Challenges Facing DVD Suppliers

- **Provide a Cost-Effective Capacity Roadmap to Meet Demand**
  - Requires 6 hours of high-quality video recording on a single-sided disc
  - With backward compatibility to current DVD Format
- **Provide Adequate Content Protection**
  - Content Suppliers Not Satisfied With Current Solutions
  - Lack of Acceptance Creates Multiple Standards
  - Cost Has Not Benefited From Economies of a Standard
- **Protect Investment in DVD Technology**
  - Large Investment in Existing Manufacturing Infrastructure (lasers, optics, media)
  - Capture a Return After Years of "Format Wars" and Before Changing to Blu-ray
  - Capture the Royalty Stream Ahead of Market before Taiwan Cost-reduces DVD
  - Price War Already Started in Attempt to Become the Defacto Standard

A New Approach is Required

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DVD & HD DVD Solutions

3 MAIN APPROACHES to Enable DVD growth:

1. Blue Laser Diode with High Power Optics
2. Dual-layer Media
3. Multilevel Recording

From Dr. Takeo Ohta, Matsushita Electric Industrial Co., Ltd. on the "Overview and Future of Phase-change Optical Disk Technology" - 1999 Joint International Symposium on Optical Memory and Optical Data Storage

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ML™ Advantages

Requirements	Blue Laser + Optics	Dual Layer	ML™
Greater Capacity	✓	✓	✓
Backward Compatible with DVD	×	✓	✓
Low-Cost Durable Laser	×	×	✓
Low-cost Optics	×	✓	✓
No Cartridge	×	✓	✓
Low-cost Disc	×	×	✓
Leverages Infrastructure	×	×	✓

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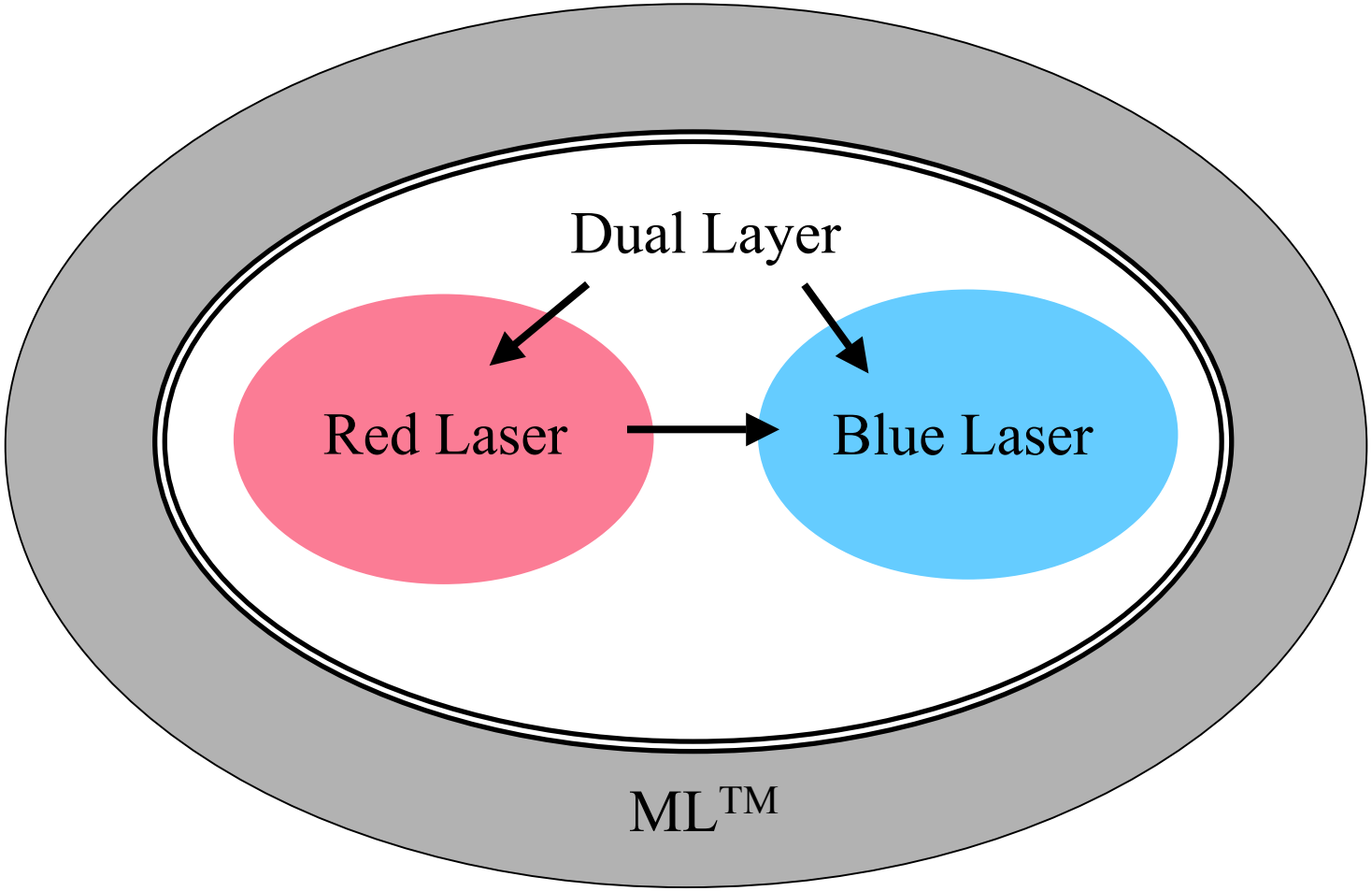
Compatibility of Solutions



ML™ Technology adds to, and is compatible with, other solutions

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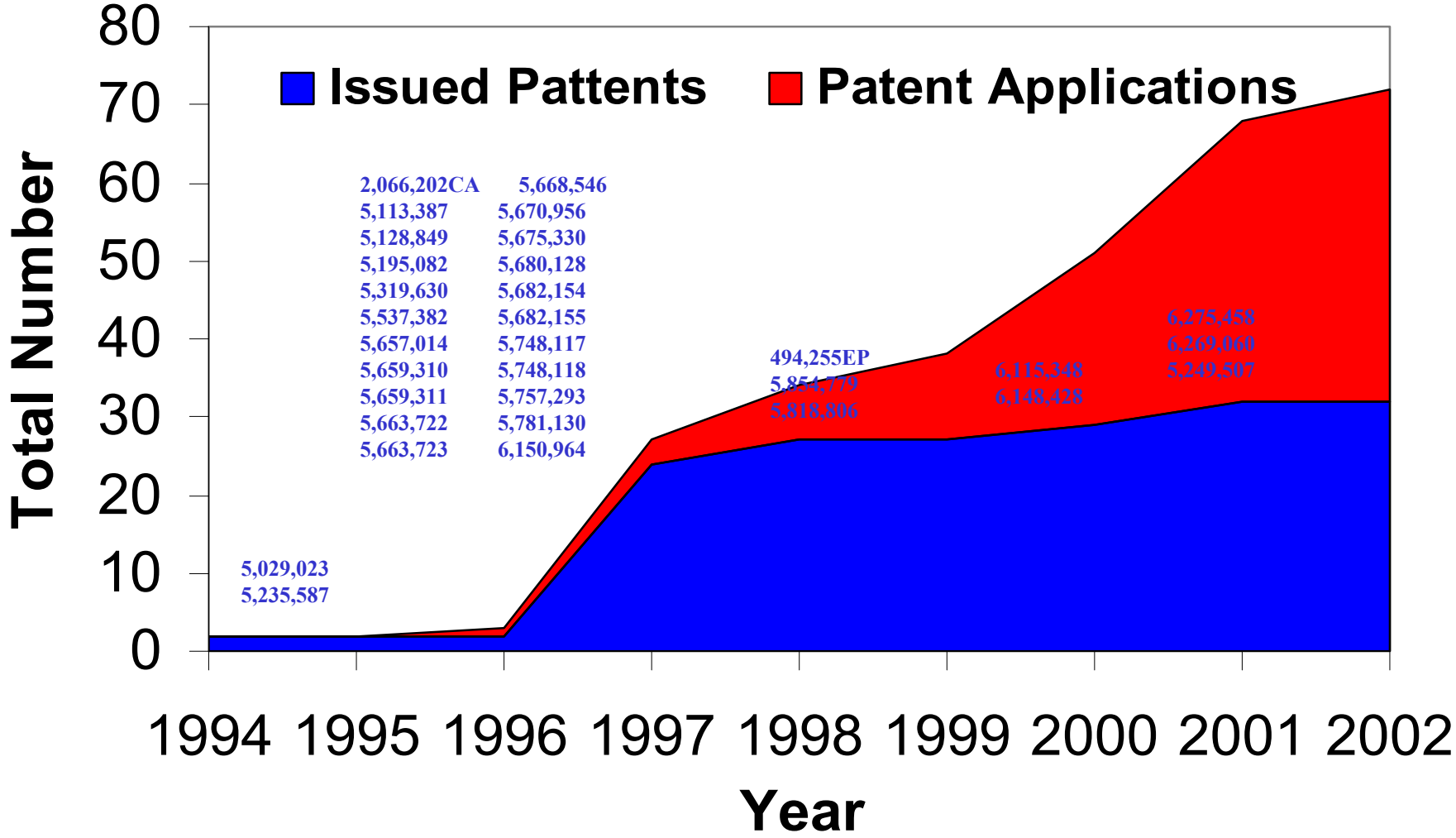
ML™ Technology Patents



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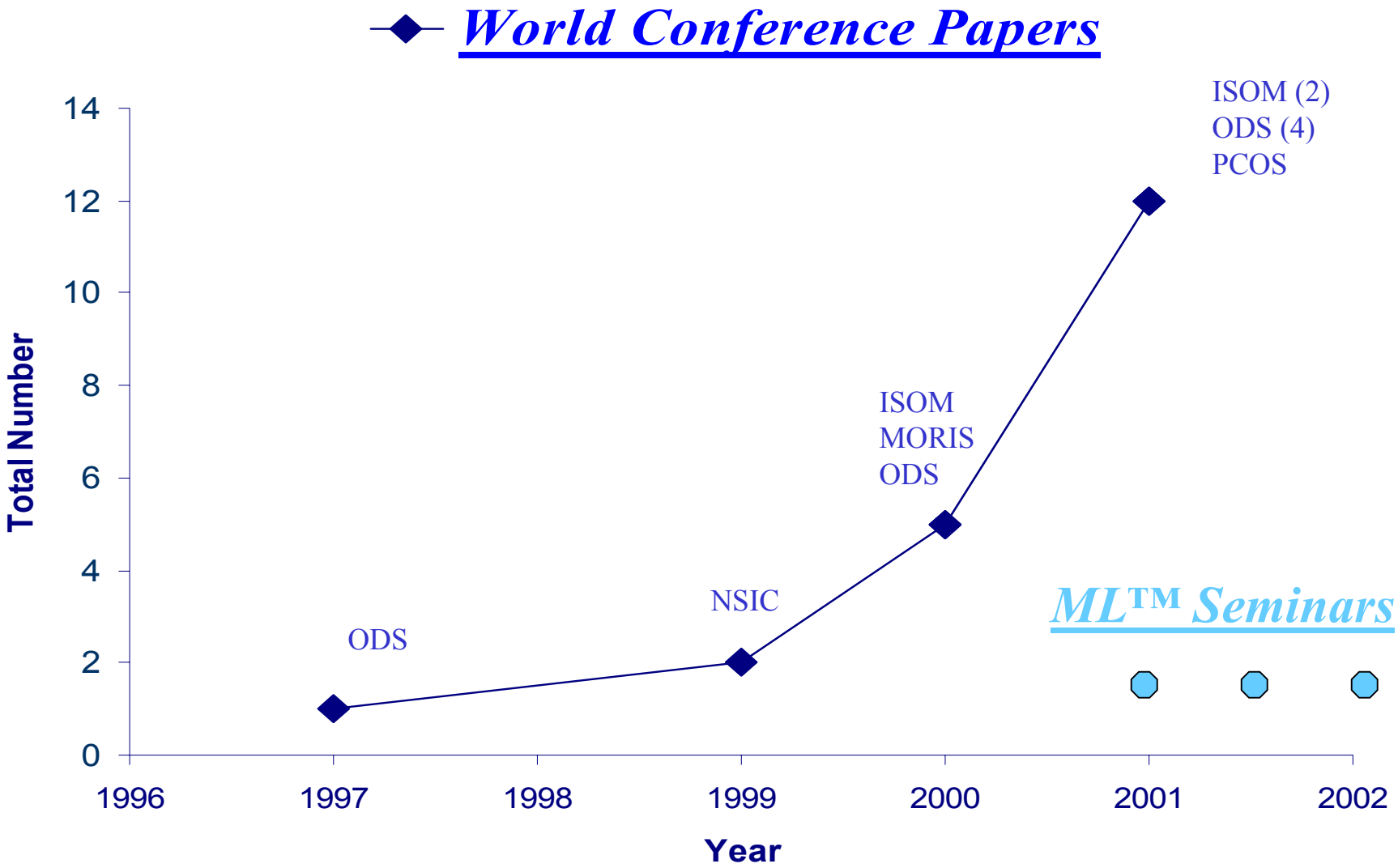
ML™ Industry Awareness



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Interested Companies

April 2001 (US)

ML Seminar

- Hitachi Ltd.
- Hitachi Maxell, Ltd.
- Komag, Inc.
- LG Electronics
- Matsushita Electric Industrial Co., Ltd.
- Matsushita Kotobuki Electronics
- Mitsumi Electric Co., Ltd.
- NEC Corporation
- OAK Technology, Inc.
- OES/ITRI
- Panasonic Semiconductor Co.
- Philips Research
- Pioneer Corporation
- Plextor Corporation
- Ricoh Co., Ltd.
- SKC Co., Ltd. Korea
- Sony Corporation
- Stream Machine
- Toshiba Corporation
- Unaxis, Inc.
- Yamaha Corporation
- Zen Research

December 2001 (Japan)

Sanyo Technology Foru

- Matsushita Kotobuki Electroni
- Mitsubishi Che
- Mitsumi Electric Co. L
- Panasonic Semiconducto
- Sanyo Electric Co., Ltd.
- Sony Corporation
- TDK Corporation
- TEAC Corporation
- Yamaha Corporation

By Invitation

March 2002 (Taiwan)

ITRI Seminar

- Accesstek
- Acer Laboratories, Inc.
- Ultima Technology Corp.
- Artec (Ultima Electronics Corp.)
- BTC Corporation
- CMC Magnetics Corp.
- Far East OST
- Fornex Technology Corp.
- Lite-On IT Corp.
- OES/ITRI
- Ritek Corporation
- U-Tech

Industry Leaders Have Accepted ML™ Technology

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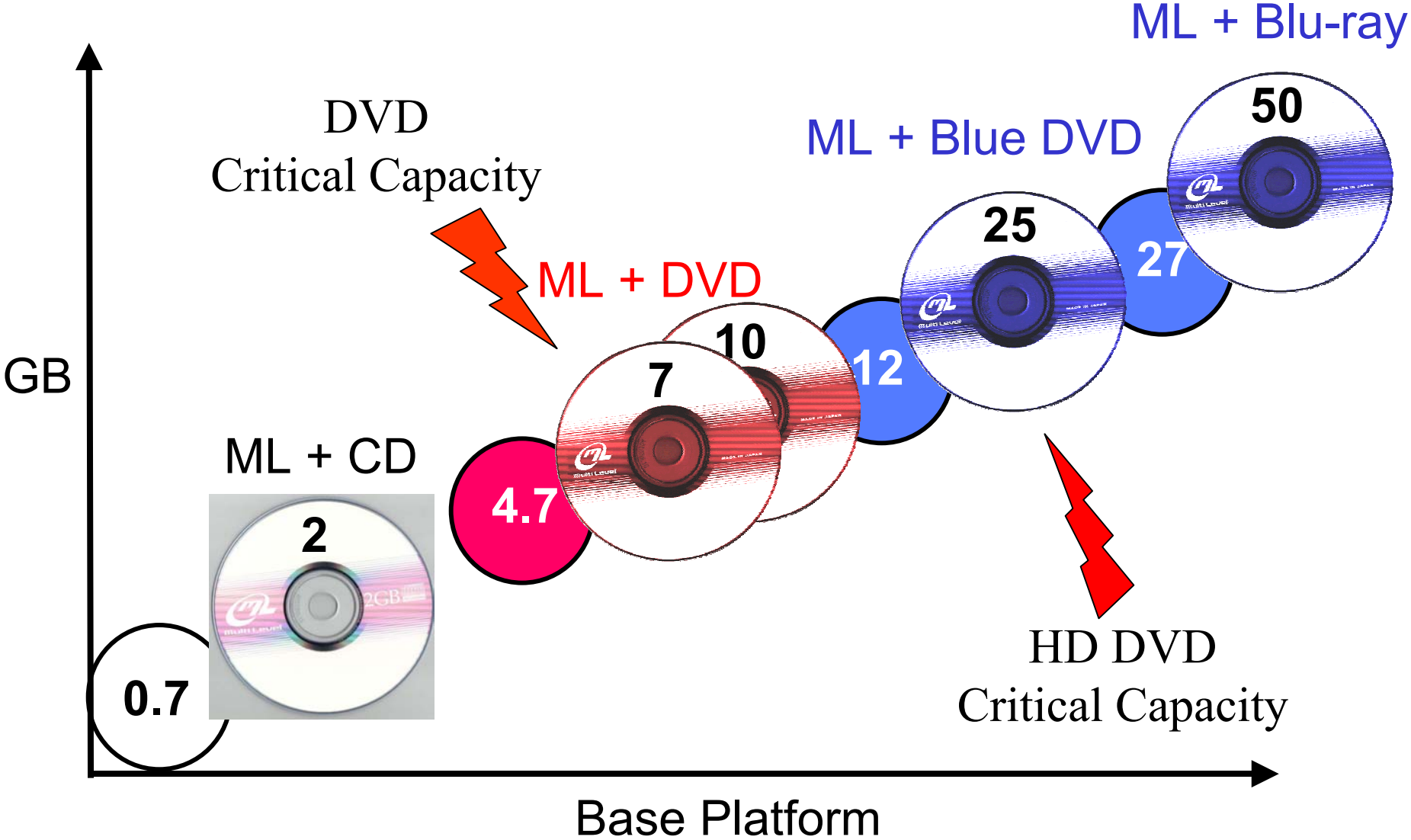
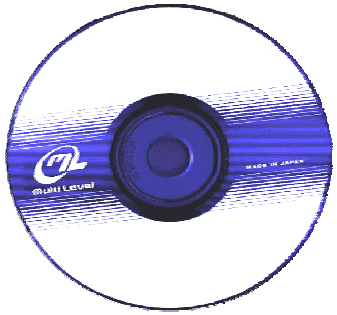
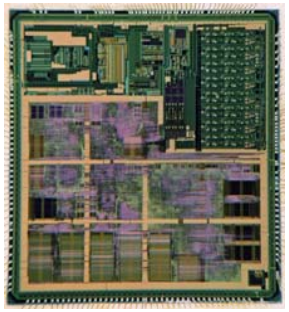
Capacity Road Map



Digital Rights Management

The KEY to DRM

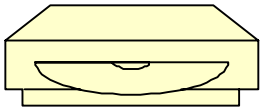




Media Stamping and Formulation

Calimetrics ASIC

Drive Firmware



Drive Hardware

ML™ Provides the Key

- **Calimetrics Controls All of the "Key" Elements of the Optical Disk System.**
  - Media Stamping and Formulation
  - Calimetrics ASIC
  - Drive Firmware
  - Drive Hardware
- **Key 1: Media** – Cannot be manufactured without proprietary hardware from Calimetrics, different features can be enabled by codes STAMPED into the disk at manufacture.
- **Key 2: Drive Hardware** – Calimetrics controls the design of the drive electronics board.
- **Key 3: Drive Firmware** – Calimetrics owns the proprietary firmware library.
- **Key 4: The ASIC** – Calimetrics owns the design of the proprietary ASIC for ML™.
- **Master Key:** Unique Combinations of these elements provide multiple options for features.

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Video Digital Rights Management

Content
Secure

Content
Not Secure

X

LEAKS

Content

Internet

'Locked'
from
Reading

Internet

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Secure Content

- Calimetrics' ML Technology Offers Unique Security Features
- ML Format Designed for Content Authors To Control:
  - Which Drive(s) Certain Disc(s) Can Be Played On
  - Unique Drive and Disc Combinations (1-to-1 or 1-to-Many)
  - Tamper-Proof Security Passwords
  - Limits on Time and Length of Play
  - Read-Once Disc Feature
- ML Security Features Minimize Counterfeiting Opportunities
  - E.g., Security Card/Identification applications

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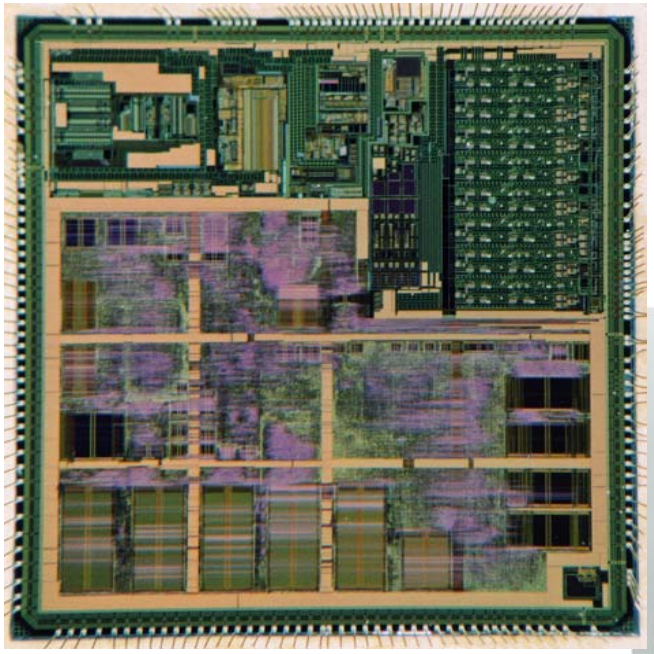
Two Major Components



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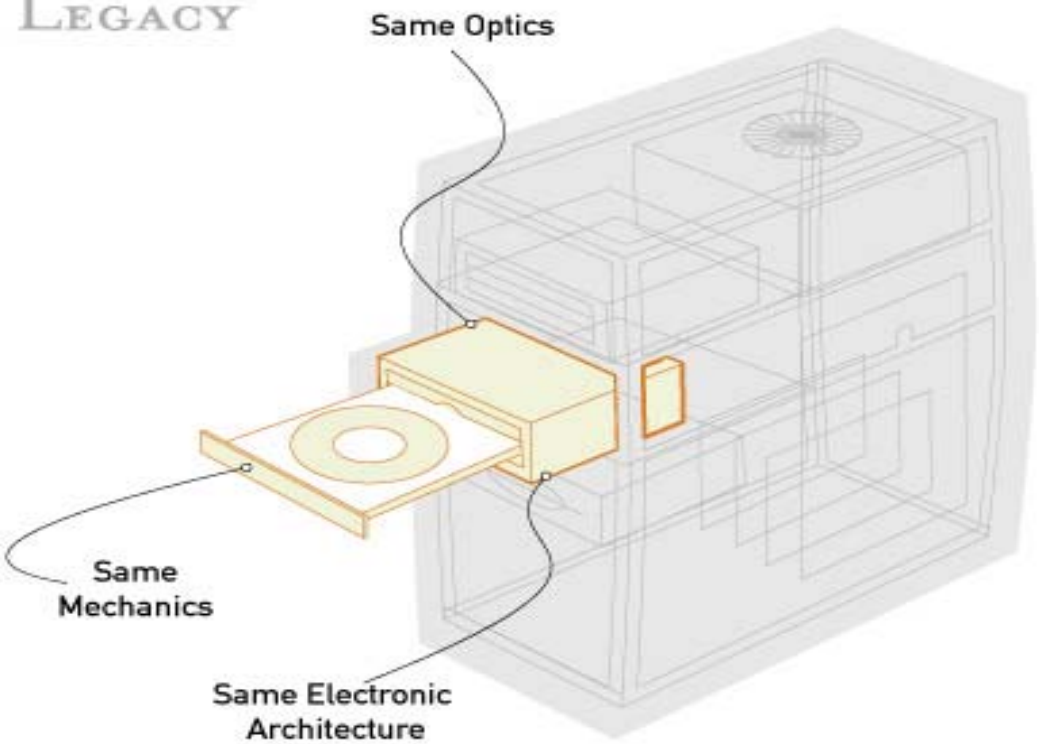
ML Optimizes The CD-RW Legacy



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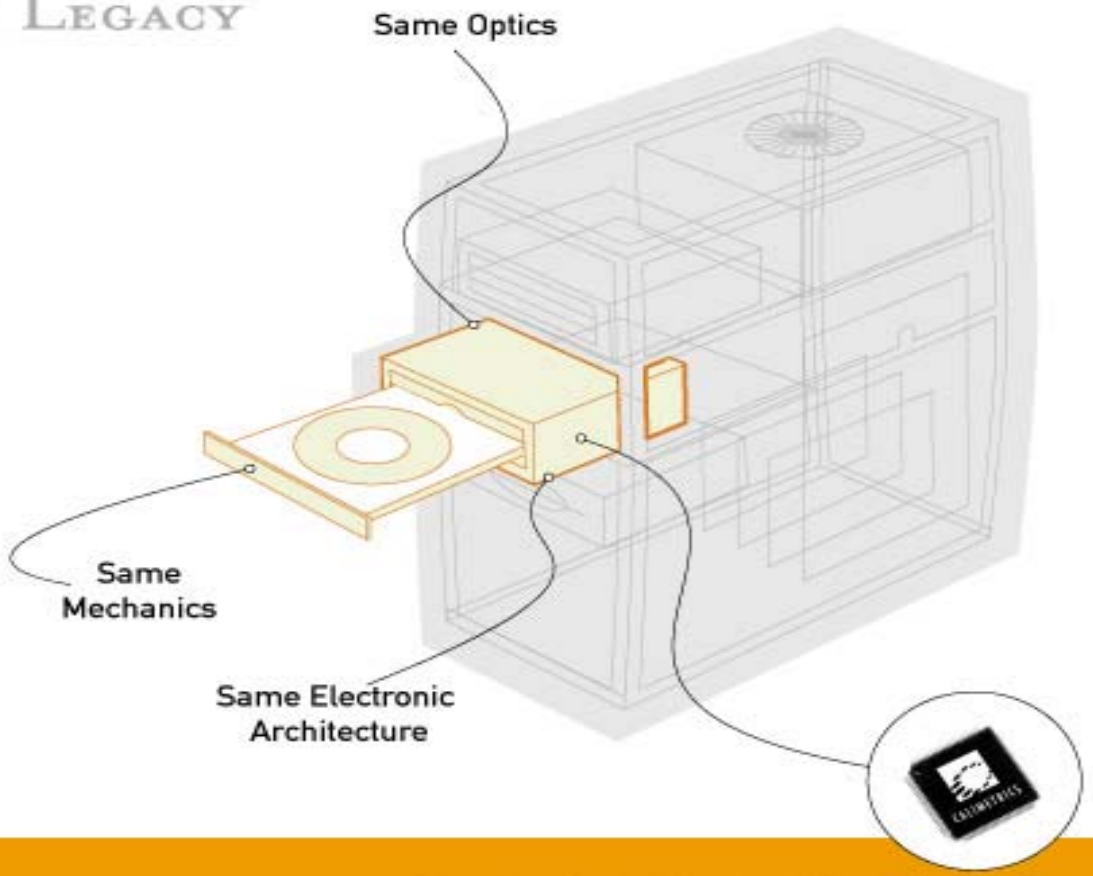

"Design In" a Single ML Read/Write Chip

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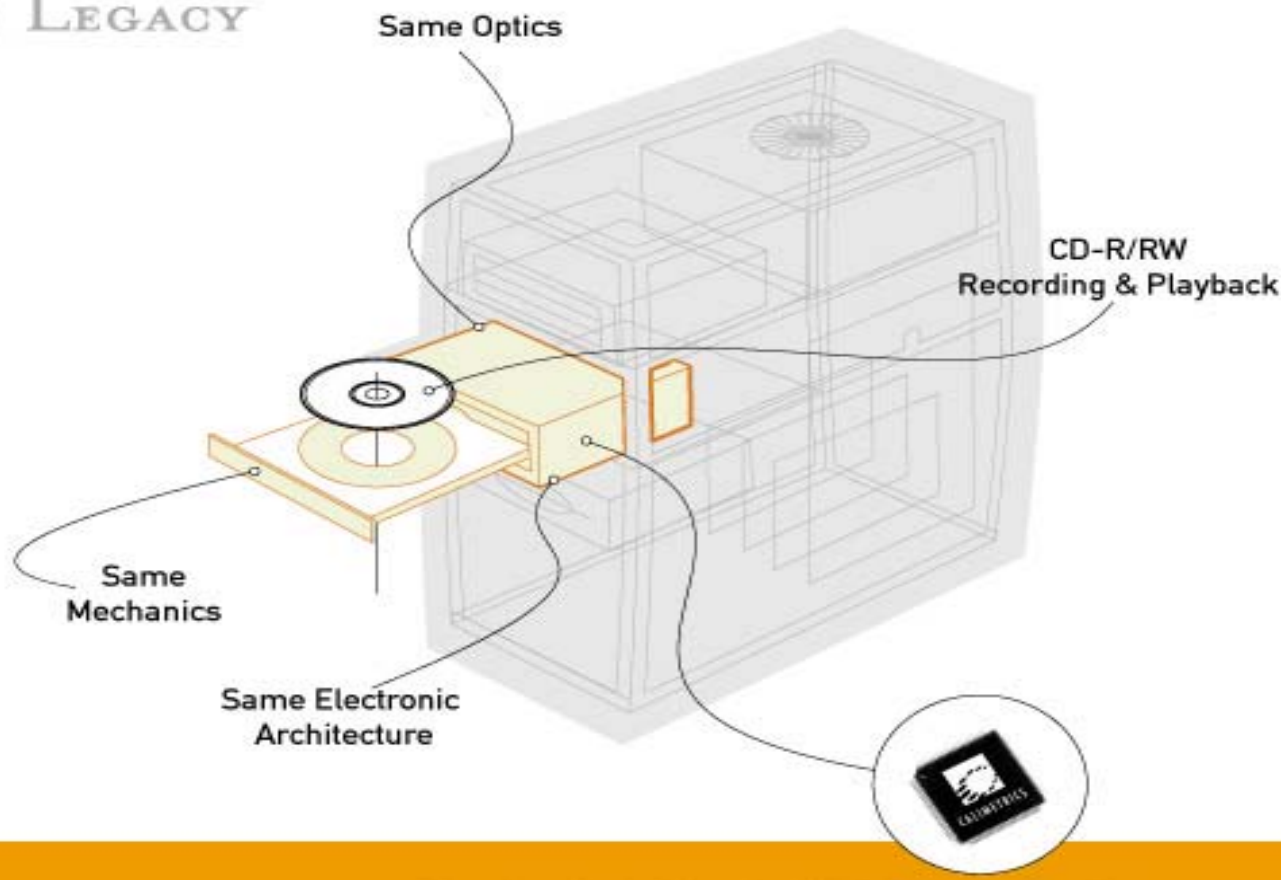
ML Optimizes The CD-RW Legacy



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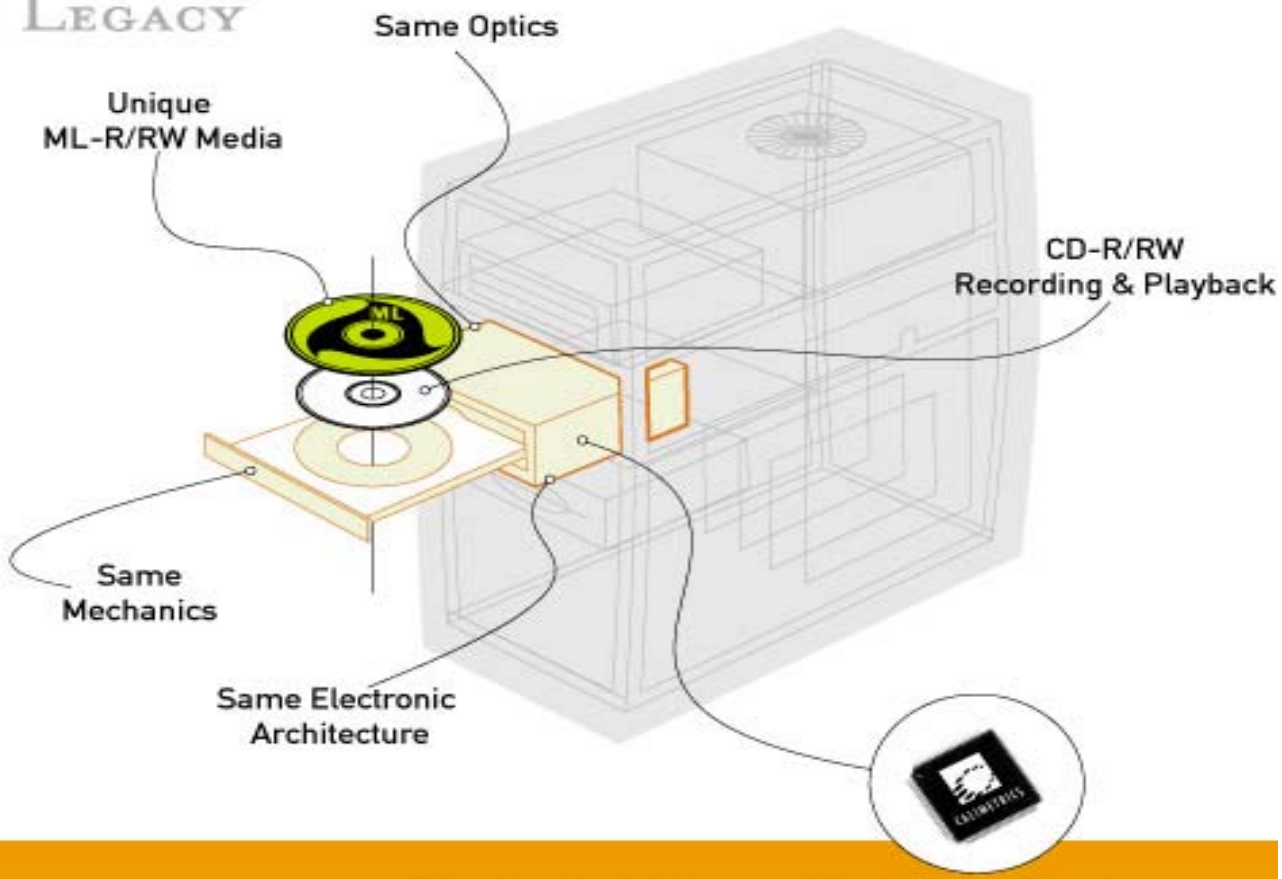

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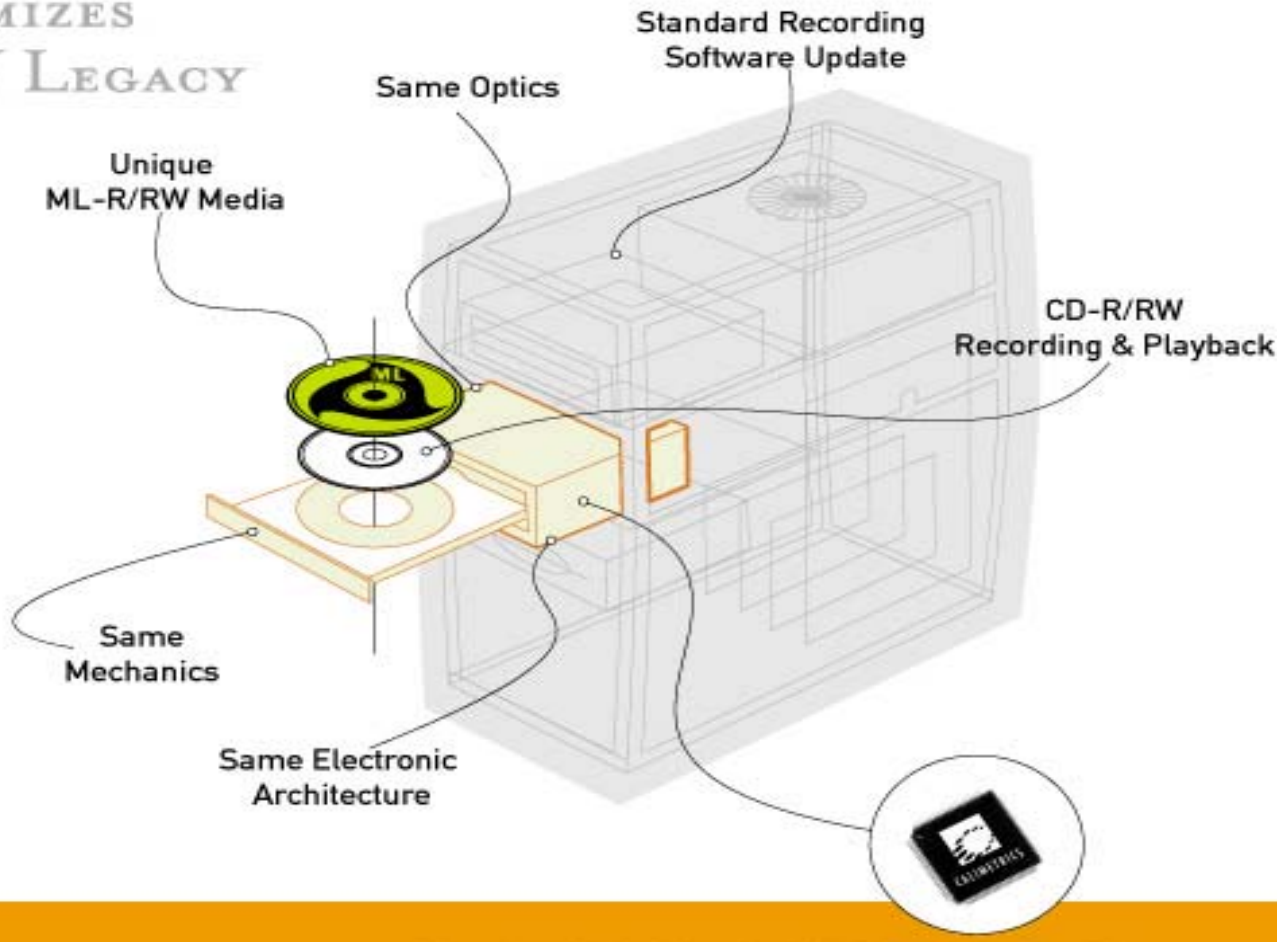

"Design In" a Single ML Read/Write Chip

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ML CD-RW: Affordable Way to Backup

- Capacity
  - 2GB in ML mode and 700MB standard CD
- Speed
  - 36X ML/5.4MB per second
- Value
  - $1/Gigabyte

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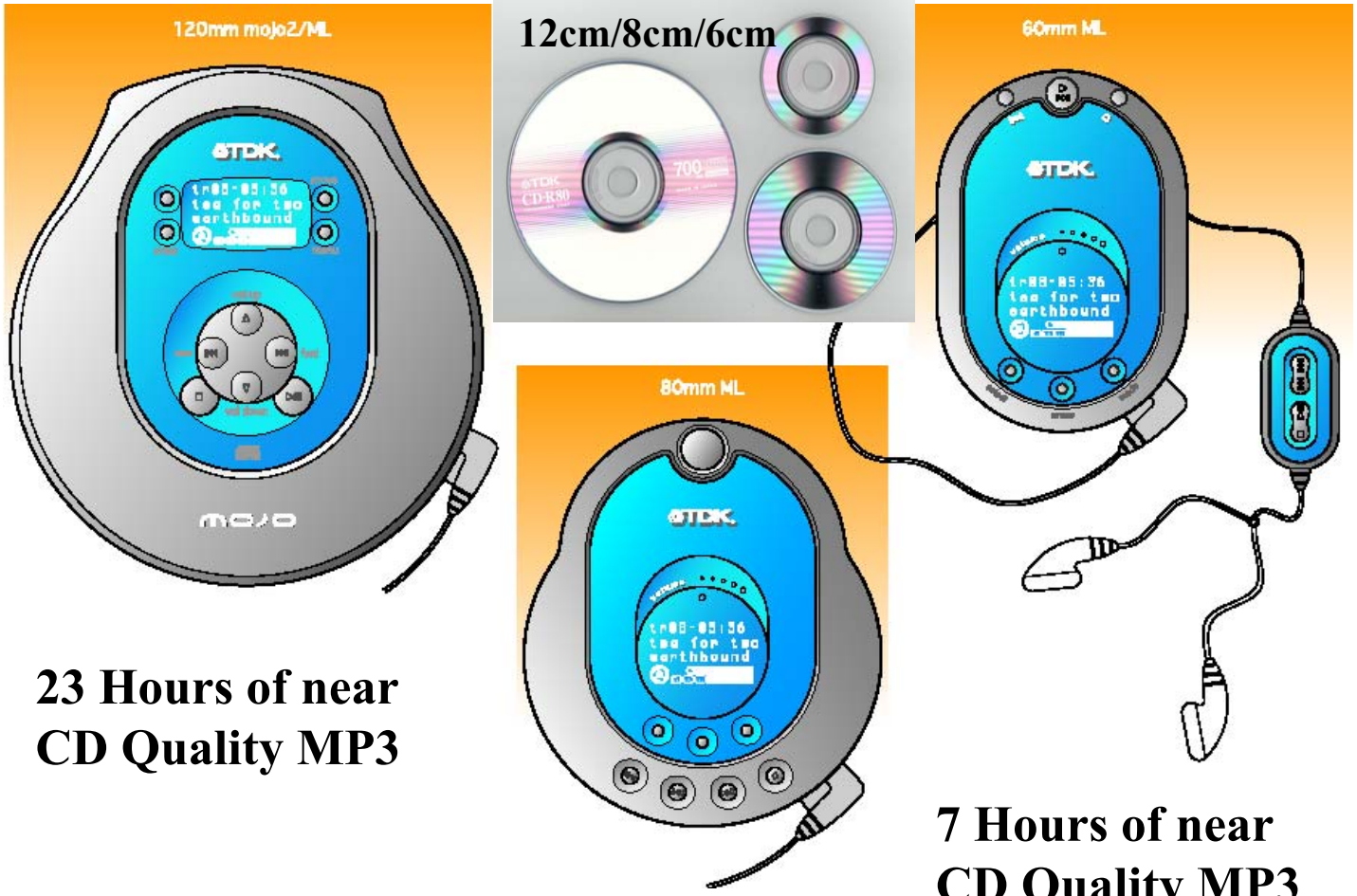
ML Audio Player



23 Hours of near CD Quality MP3

7 Hours of near CD Quality MP3

74 Min CD Audio

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ML Applications: Enterprise

- ML Writing Speed is Fast…More Than 2 Times Faster Than Recordable DVD Systems.
- ML's 5.4MB/s Data Transfer Rate Is Very Attractive to Enterprise Backup Apps Currently Using Jaz, MO, and/or DVD Recordable Systems
- Cost of storage and ownership lower than competitors

Security ***Network Storage***

Backup ***Archival***

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ML Applications: Desktop

- Affordable, Reliable ML CD-RW Drives and Media Offer the Speed & Capacity that Professionals Demand

Video Production

Pre-Press

Graphics

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ML Applications: ML VCD

Format	VCD	HQ VCD	SVCD	DVDPhoto	CDDVD
Standard	74 min	37 min	37 min	98 Images	18 min
ML	3.7 hr	1.8 hr	1.8 hr	294 Images	54 min

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Multi Level

Enabled 2 Hours HQ Video At Home or on the GO!!

8 cm Disc

6 cm Disc

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Customer Opportunities

- ML™ CD-RW
  - ML ASIC and ML CD-R/RW 2GB discs are completed
  - Fully-operational ML CD drive prototype available for demonstration
  - Calimetrics is ready to implement ML for customers' applications
- ML DVD
  - ML ASIC enables 7GB/disc recording on a DVD base
  - Next ML ASIC under development for 10GB/disc on DVD
- ML Blue
  - Next ML ASIC will also enable 25GB/disc with 0.6mm substrate
  - 50GB/disc feasible with proposed Blu-ray format
- Unique Security Features and Digital Rights Management