Optical Disc Archiving

using the guidelines defined by the international standards

JVC Advanced Media Europe GmbH

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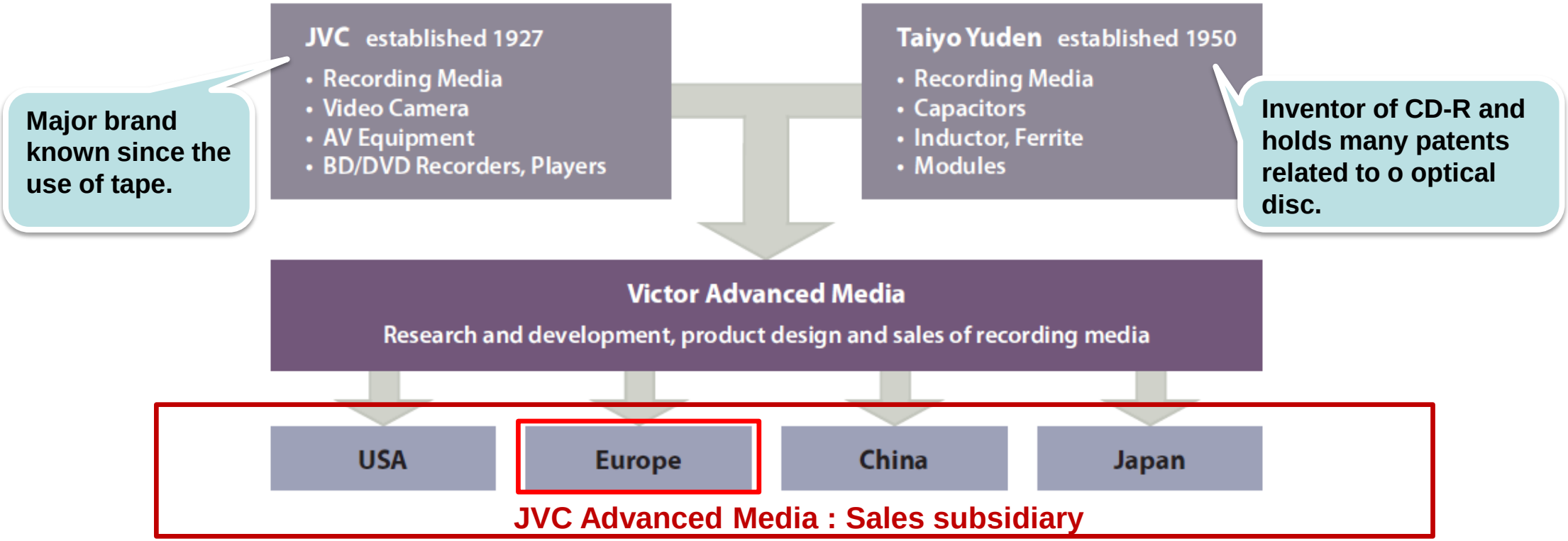
Company Introduction



Optical Disc Archiving

using the guidelines defined by the international standards

1. The requirements for preservation on optical discs and ideal solutions.

2. Obsolescence risk of play back infrastructure

3. Technology road map of JVC

General requirements for recordable medium

1. Life expectancy

to keep the data for a certain period.

2. Periodically data condition checkable

Capable of playing the data back properly and the periodical inspection of its condition.

3. Authenticity.

However, in the Optical Media Industry …

- International guidelines for test & operation have not been widely known.
- No complete system available up to now.

⇒ The situation forced users to use their own guidelines without correct understandings.

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What are requirements for archiving with optical discs?

1) ARCHIVE QUALITY MEDIA:	Use of archive quality media that passed the proper longevity test method set by international standard
2) OPERATION	Error management based on the international standard
3) DISC FORMAT	Physical formats set in the international standards

By complying with the international standards, users can minimize the risks of loss of precious data.

Status of standards related to archiving for optical discs

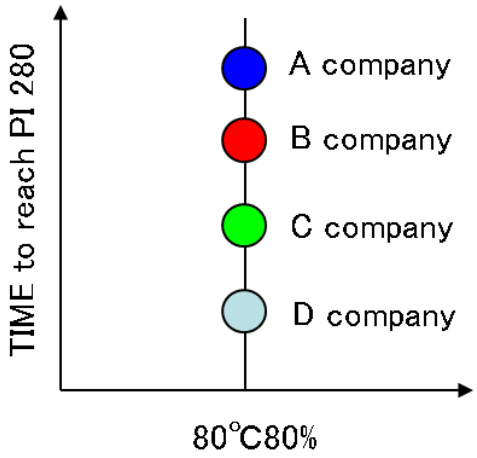
		Life expectancy test	Operation	Format
CD	ISO	ISO 18927 ISO/IEC 16963		ISO/IEC 10149
	JIS		JIS Z6017	JUS X 6281
DVD	ISO	ISO/IEC 10995 ISO/IEC 16963	ISO/IEC 29121	ISO/IEC 16448
	JIS		JIS X 6255 JIS Z 6017	JIS X 6241
BD	ISO JIS	Being standardized by the optical disc industry organization.		

JIS : Japanese standards

The international standards related to optical disc archiving are set for CD and DVD : Format, Life expectancy test, Operation.
The similar standards for BD are being elaborated.

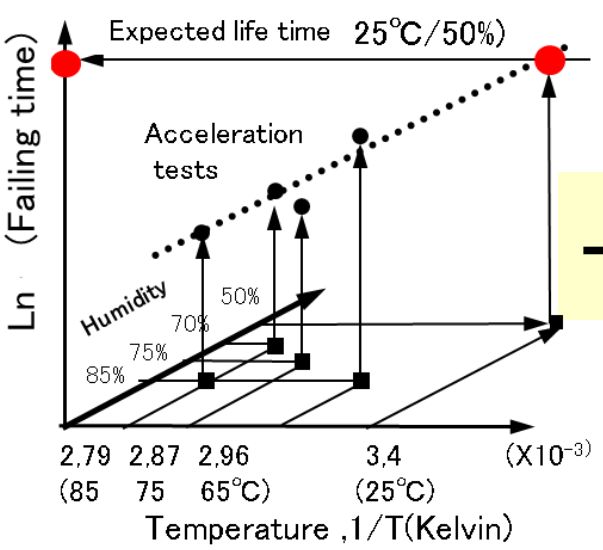
ISO/IEC10995 vs. General test

General Test



(**Simplified into a 2-dimensional graph**)

ISO/IEC10995, ISO/IEC16963 Test



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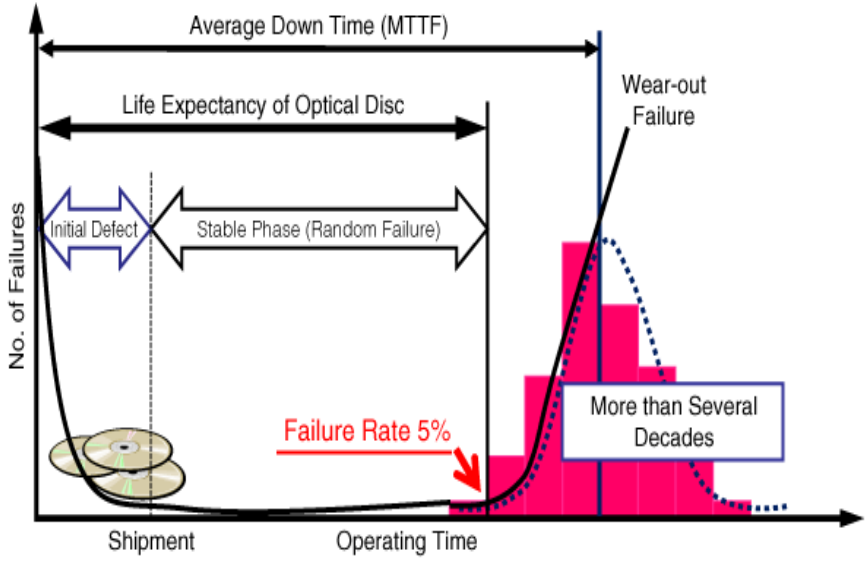

We used to use one stress condition to estimate the life time.
However, does using the break-test method really estimates longevity at users' storage condition?
We think multiple conditions' test are mandatory to give users longevity information as accurate as possible even if the test is time and resource consuming.
This is what ISO test focus on and we are utilizing this method to deliver safe operation to users.

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ISO/IEC29121 – For visible evaluation of media condition

ISO/IEC29121 defines the safe level of errors at the time of recording and during storage.

				Book Spec (Disc makers to make upon)	Migration standard		
				ISO	ISO/IEC 29121	JIS Z6017 (Japan)	DA/T38 (China)
DVD	Initial recording Performance	Level 1	Recommended	< 280 (Disc manufacturer to comply at the time of manufacturing)	< 140	< 100	< 80
		Level 2	Should not be used		140 – 280	–	–
		Level 3	Shall not be used (Out of spec.)		> 280	–	–
	Recording performance at periodical performance test	Level 1	Use as it is		< 200	< 140	< 140
		Level 2	Migrate to another disc ASAP		200 – 280	140 – 280	< 180
		Level 3	Migrate to another disc immediately or might be not retrievable		> 280	> 280	> 240
	Testing period of recording performance	–	–	Does not specify	Every 3 yeas or less	Every 3 years	Every 2 years or less

Error management enables users to avoid data loss.

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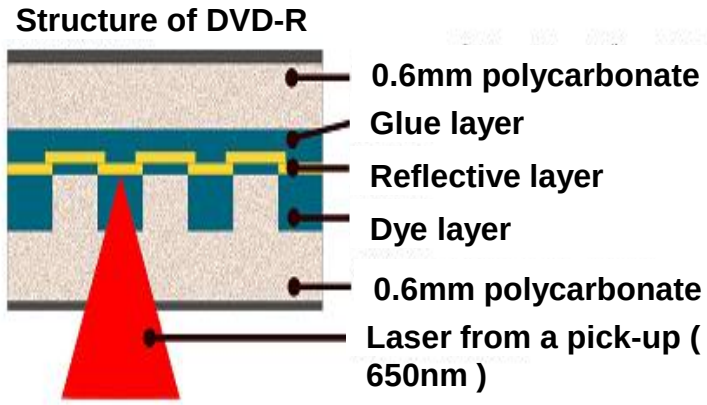
Reasons of error escalation on optical discs

Slow chemical reactions by water diffusion is considered degradation in desired material property used for optical discs, such as reflective layer and dye layer.



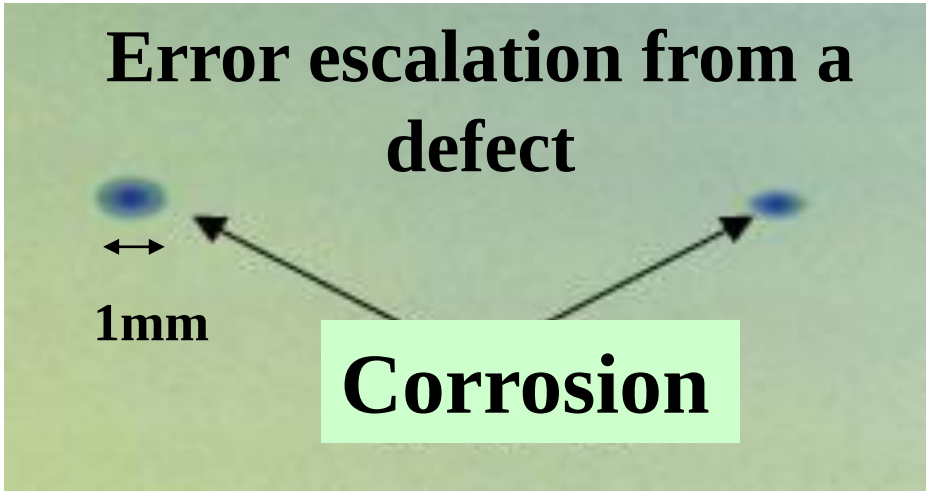
The error escalation that causes playback issues have relation with ;

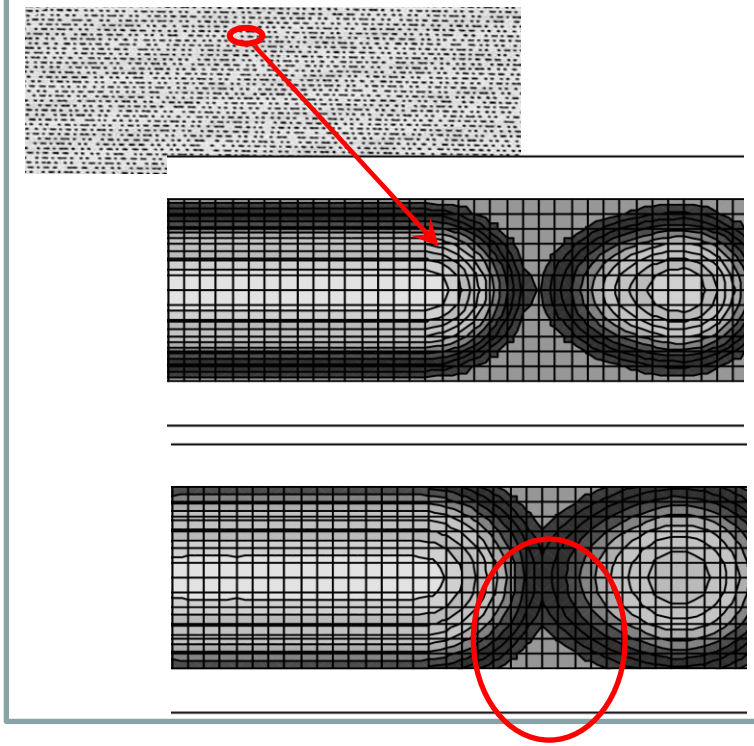
- **Error extension by corrosion from a defect.**
- **Pit formation change due to the degradation of dye material.**
- **Change of mechanical characteristics (such as tilt).**

Use of Quality disc + Visible management
=> minimize the risks of data loss.

Error escalation risks

- **Error extension by corrosion from a defect.**



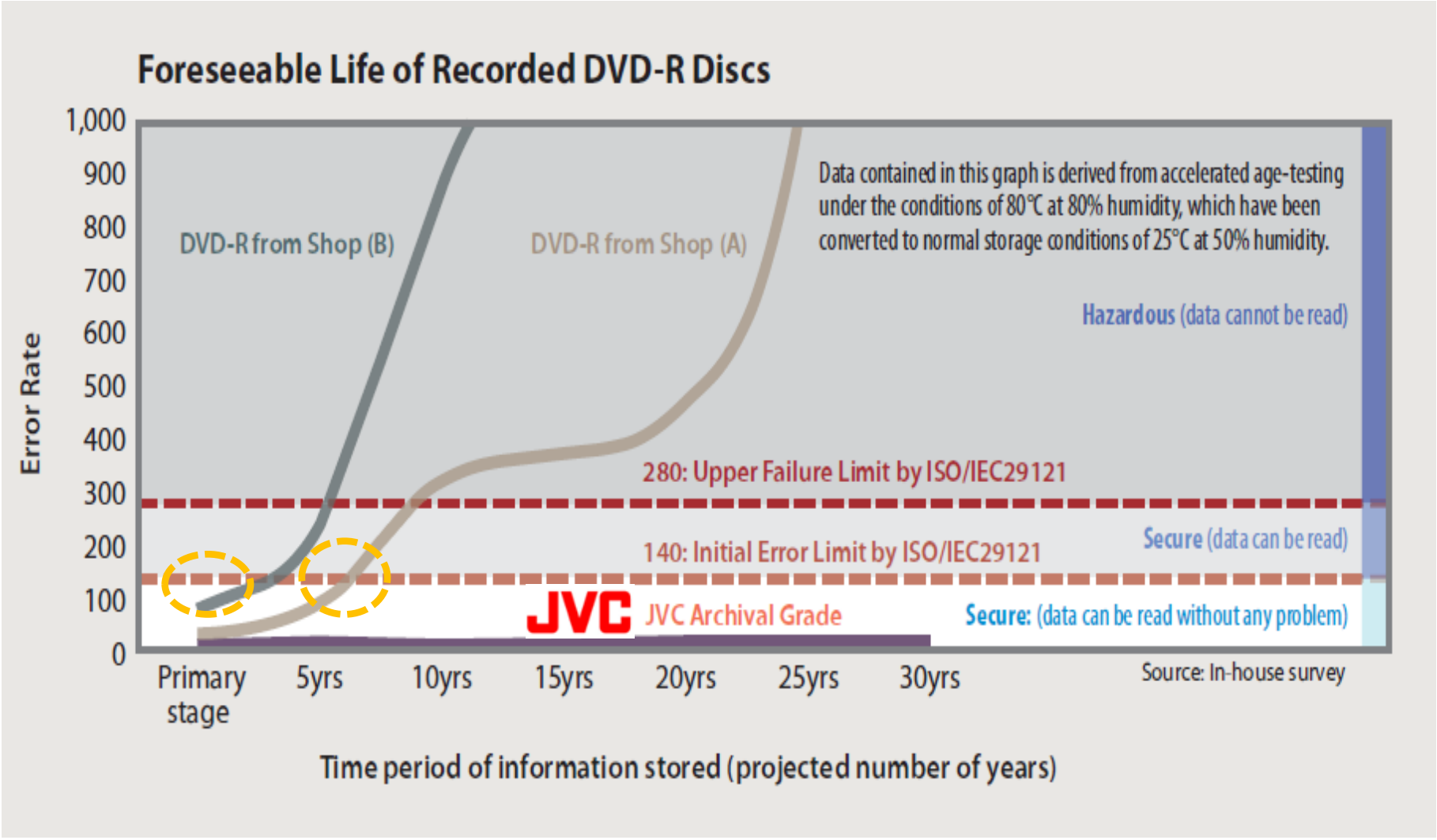


- **Pit formation change due to the degradation of dye material.**

Status signal immediately after recording with accurate length

Dye decomposition occurs and the boundaries between signals become unclear and data unreadable due to humidity and temperature.

The importance of initial error rate



Initial errors have a strong relation with the life time of the stored data.

The error rate and compatibility

Initial error rate of major brand's media with different drives

Media	Drive									
	Maker A		Maker B		Maker C	Maker D	Maker E		Maker F	
	Drive A	Drive B	Drive C	Drive D	Drive E	Drive F	Drive G	Drive H	Drive I	Drive J
Brand A	93	175	211	424	161	100	639	1367	655	287
	102	36	220	163	406	576	365	1664	513	192
	330	101	166	252	100	215	569	1227	539	169
	176	142	272	92	1130	60	428	1450	171	64
Brand B	112	64	263	120	1154	931	171	1481	failed to write	38
Brand C	130	43	67	56	629	215	232	1330	135	124
	450	103	438	376	681	169	593	1664	116	59
Brand D	224	367	522	336	1264	143	156	255	174	127
	218	137	84	103	324	104	885	1202	1069	413
	1613	778	410	846	670	80	1351	26	53	28
Brand E	1615	65	106	445	1497	110	746	87	480	14
Brand F(Gold)	86	838	163	208	167	1019	1247	1664	497	277
	1200	43	1634	105	1224	178	390	1419	213	138
Brand G	529	49	1185	373	761	150	725	1664	431	407
	508	260	67	523	1324	46	714	1622	98	43
	317	348	778	132	1664	1579	907	142	921	15
	77	1402	257	33	1664	1652	310	1607	1122	7
JVC	93	33	3	55	115	42	39	1604	99	36

Initial error > 140

Initial error > 280

Source: In-house survey

All error rates are decided by the quality of the drives and media used.

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Ideal Solution for Optical disc archiving

1. Archive Quality Media

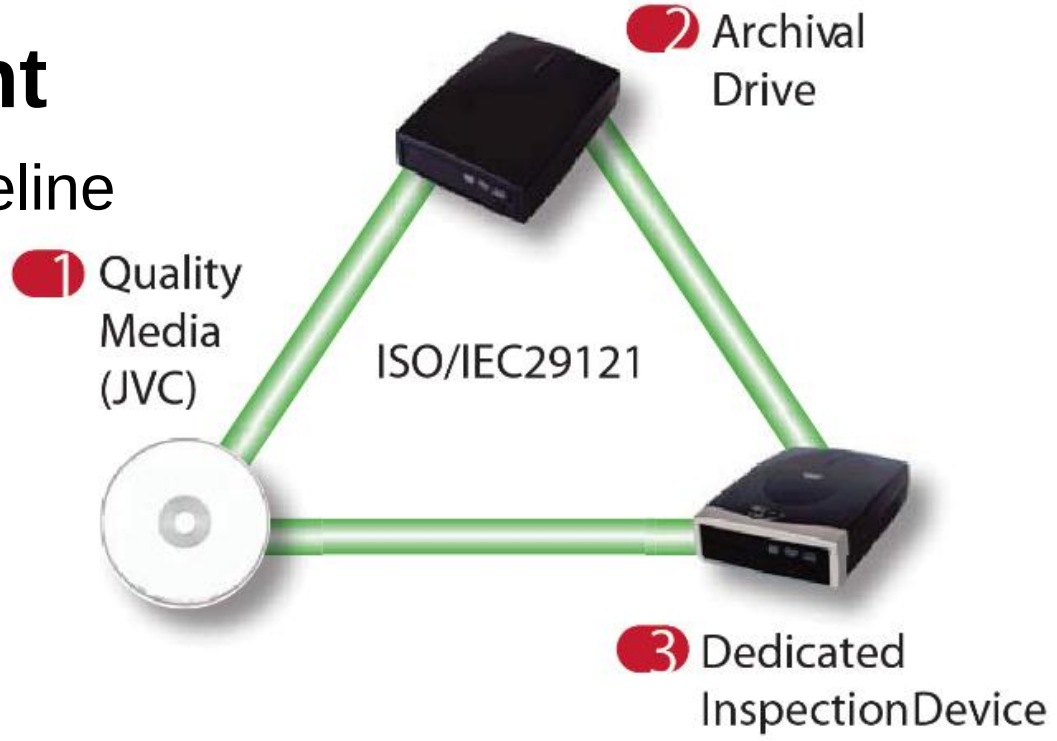
that passed the test method set by the international standard

2. Dedicated Archive Drive

that optimized to the quality media

3. The Error Management

based on the international guideline



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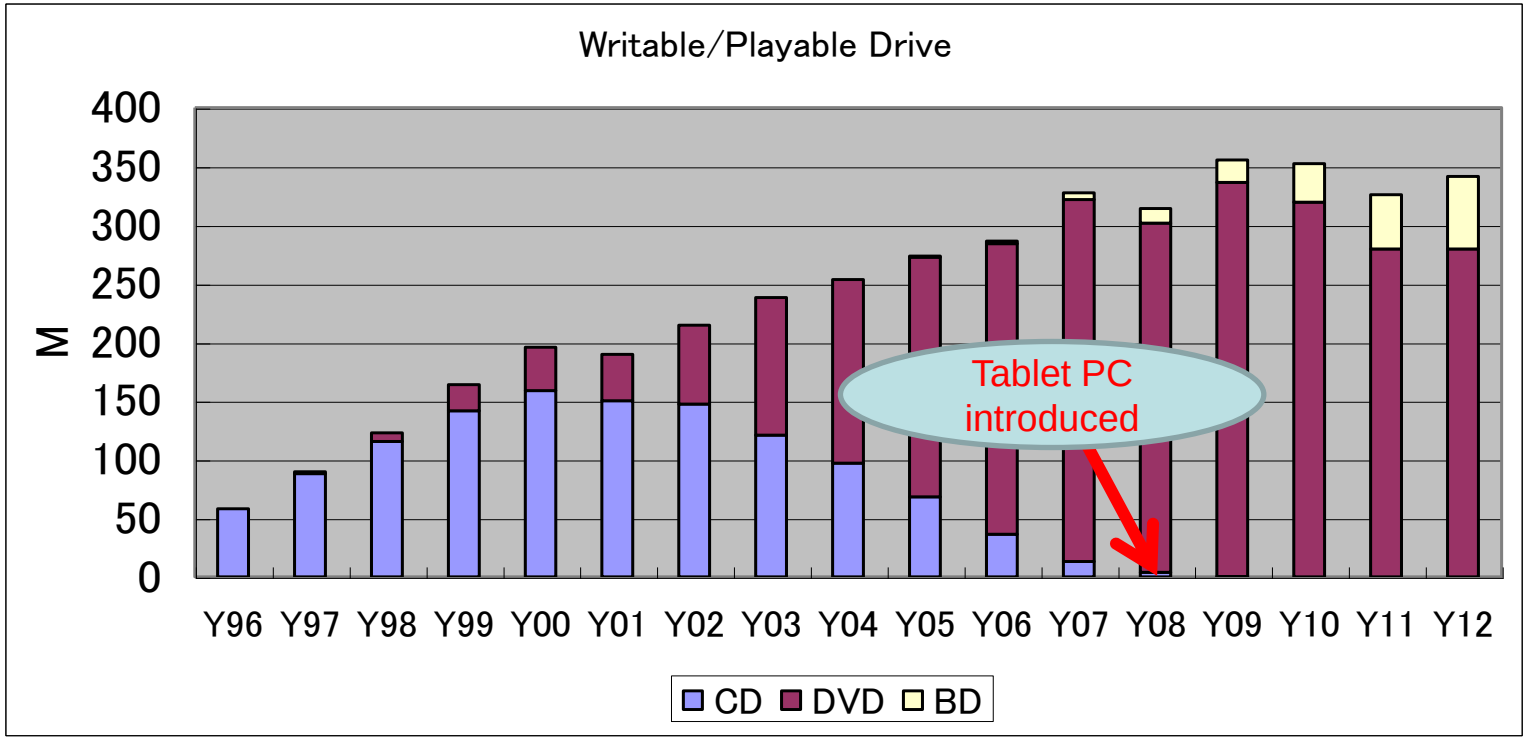
Actual usage in abroad

CHINA : The solutions are used at National Archives and State Archives

JAPAN : The media passed the test complies to ISO/IEC10995 method is specified for the medium to store the digital data by historical document museums.
The specification also requires the evaluation of the errors based on JIS Z 6017.

* JIS Z 6017 : The Japanese Standard equivalents to ISO/IEC29121

Obsolescence risk of play-back infrastructure is minimum



1) Even this “cloud” era, 300Mio drives are shipped out every year.

2) Total Infra of “Play-Back” is larger than 4.0Bio

3) High backward compatibility - Blu-ray drives are also capable of playing CD and DVDs.

A couple of facts…

Popular VHS

VHS player/recorders were quite popular, they can still play without difficulties…

The playing infra for “-R” type recordable media is **x 4 to 5** larger.

3.5 in Floppy Disc

CD format and floppy disc, the both technology were born at the same time…

CDR have been said that the format would be obsoleted for 10 years. Even server manufacturers are still relying on the format for software preservation.

External HDD

Interface has been changed a couple of times… (SASI SCSI USB1)

NO PC plays “SASI” HDD anymore…

Optical Discs have high capability for digital data preservation

- **AUTHENTICITY** : Data cannot be altered when once recorded
- **OBSOLESCENCE RISK** : Largest format and standard
- **RISK FINDING** : Extremely easy by checking error rate
- **STORAGE** : Wider flexibility (recommended at 25C + 50% RH)
- **MANAGEMNT**: Extremely easy as bookshelf
- **ZERO VIRUS RISK**: Off line copies. No risks.