The experience of RAI DigiMaster Project, in progress..
RAI analogue archive is made of .. Now digitisation is in progress, however.. and we cannot be sure to get it at 100% successful end.

Decisions and criteria

Betacam highly automated process..

Regarding the films, the troubles are..

Quality of results

Other aspects into account.. Sifting the archive.. Immediate exploitation vs long term span
RAI analogue archive is made of..

- Rai TV broadcast began in 1954 .. now there are 13 channels
  - Millions hours of content have been transmitted
  - Hundreds thousands programmes produced internally

- Rai archive represents:
  - The history of television
  - And that of the Country

- Amount of items limited to Roma, via Salaria store

Mass digitisation with a focus on film
The experience of RAI DigiMaster Project, in progress..
Now digitisation is in progress..

- In Roma via Salaria, in service since 2017
  - Up to 30 digitisation lines for Betacam/IMX
    - Automated, by use of Robotics; process including Tape Cleaning
    - Capable to digitise up to 600 tapes per day
    - Target is 2100 tapes per week
  - Up to 7 digitisation lines for Film 16mm
    - A lot of manual work
    - Not yet a realistic target rate
    - One line can work on 35mm as well
- Other system now active in Torino (6 lines)
  - And up to further 36 Betacam lines for the regional archives are going to start in 2019

However..

- Process is slow to reach the wished speed
- Time plays against
- Awareness of actual risks
.. and we cannot be sure to get it at 100% successful end

- The context now is reasonably good shape
  - Video tapes are quite good condition
  - Players are still available in working condition
  - Skilled staff

- New troubles may arise before end of digitisation process
  - Film situation may turn worse
  - Equipment and skilled staff availability
  - Quality of result in future context
Decisions and criteria

- The target file formats
- Work-flow
- Equipment
- Priority and selections
- What is meant by “massive”
- Exploitation perspectives

File formats must:
- comply to standards
- fit immediately in the current TV production process
- ensure to keep the original quality

Work flow must:
- integrate at both ends with organisation
- allow modular deployment
- permit to manage exceptions

Equipment must:
- be purchased via public tender
Decisions and criteria

The target file formats
Work-flow
Equipment
Priority and selections
What is meant by “massive”
Exploitation perspectives

Priority
- editorial interest
- danger of loss
- better result

Copy selection
- master
- better result
- better use of resources

Massive means
- Not be pedantic with quality
- Simpler first - Digitisation only
- Alternative WF for problematic cases
- Output not ready to “on-air”

Exploitation perspectives
- Re-injection into documentation work-flows
  - greater re-use probability
- Some re-uses are already expected
  - digital restoration work-flows
Betacam highly automated process

- Work module is “the Chain”, i.e. whatever is around a Robotic
  - 60 shelf video tape bins
  - One cleaner, 3 Players IMX/eVTR
    - i.e. 3 digitisation lines
  - 4 servers
    - 1 server/line + 1/chain
- Overall process can work with as many Chains as wished
Betacam highly automated process

Robotic detail

Cleaner with dry cleaning tissue
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**Betacam highly automated process**

- Target File Format is MXF/D10
- Storage requires ~30 GB/hour
- Approach based on IMX/eVTR as player, when possible
- Baseband (SDI or Component) otherwise

Sony MSW-2000 e-VTR

eVTR BKMW-E3000
Betacam highly automated process

- eVTR allows FTP access over Ethernet connection

Quality data board
- Y+C RF level
- Y+C drops
- Control Track
- timecode

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The workflow

Media carriers
- Check In
- Tape/Film Digitisation
- Programme Reel Cut

Programme Master Files
- Quality Control
- LTO/LTFS copy
- Check Out and Delivery

Scalable Architecture
- Process Management
  Communications, Work Flows, DashBoard
- Chains
  Robotic, Cleaner, LTO..
Regarding the films, the troubles are..

- Films conditions
  - Most films have not been handled for decades
  - You may smell vinegar.. syndrome is around
  - Vinegar syndrome evaluated on samples with AD-strip
- Time plays against
  - Part of collection has reached auto catalytic point
  - For part of the collection this is likely the last and only digitisation opportunity
Regarding the films, the troubles are..

- A lot of manual work
  - Time consuming and expensive
- Levels of work Preparation and cleaning
  - Basic checking
  - and Repairing
  - and/or Assembling
- Difficult to forecast needed time
  - From 4 to 10 hours per hour of film

- Evaluate general state and quality
- Put leaders and cores (if required)
- Clean manually hard trace
- Repair splices and damages
- Check I/S synchronization (when SEPMAG)
- Assemble small reels (if needed)
- Edit a list of assembly (if needed)
- Provide a technical report
- Clean in a film cleaner
Regarding the films, the troubles are..

- A chaos of copies
  - Programme made of reels
  - SEPMAG
  - Copy or production in a Video Tape format

- What about assembling small rolls?
  - We want to, esp. for News films (50s-80s)
  - Not yet in place

**Disadvantages**
- Preparation longer and more expensive
- Additional trouble with SEPMAG
- Needs new material with edit list

**Advantages**
- Easier and faster process
- Easier and safer storage
- Lower use of leader and cores
Regarding the films, the troubles are:

- Target file format
  - Image resolution
  - Current scenarios for 16mm
  - Next scenario for 35mm
    - 4K scan

16 mm film

Low end
Kinescope films

High end

MXF
AVC-Intra
1920x1080p25

2.3K DPX
uncompressed

Video 100Mps
422 - 10 bits/sample
Pillar box 1440x1080

for exploitation in TV Production scenario

for later digital restoration and high end exploitation in all scenarios

Mass digitisation with a focus on film
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Quality of results

- Quality along the digitisation chain
  - Media carrier preparation
  - Players in well condition
  - Well consolidated software
  - Skilled personnel for monitoring and closed-loop tuning of devices

- Quality assessment of produced master files
  - Use of content analysis software
  - Eyeballs check by skilled personnel
Quality of results

- The primary goal is to preserve the content
- Keeping the original quality
  - If the original video or audio was scratchy, the file will also be
  - Master Files not suited for direct broadcast without a further check and/or post-production process
- A compromise with the pace of work is necessary
  - Time plays against
    - Better preserving everything with 95% quality that just half archive at 99.9%
Mass digitisation with a focus on film
The experience of RAI DigiMaster Project, in progress..

Quality along the digitisation chain

▶ Media carrier preparation

▶ Players in well condition / maintenance
  ▶ including head cleaning, replacement or regeneration
  ▶ unexpected problems on the player can be detected during the assessment of master files

▶ Well consolidated software
  ▶ avoids re-encoding when possible (e.g. eVTR for IMX digital tapes)
  ▶ minimum loss of quality using state of the art encoding when passing through baseband
  ▶ standard compliance checking of output master files
  ▶ fixity checking of files when transferred or manipulated

▶ Skilled personnel for monitoring and closed-loop tuning of devices
  ▶ Personnel with long experience in A/V, they know very well the typical defects of the specific formats
Quality assessment of produced master files

- Use of content analysis software
  - formal check of wrapper (e.g. MXF) and bitstream (e.g. MPEG2) layers
  - baseband analysis to detect audio silence and video major breakouts

- Eyeballs check by skilled personnel
  - aided by previous content analysis, RF VTRs measurements, and pre-existent technical sheets
  - limited to critical parts plus few random intervals

- Expertise of technicians allows to
  - Identify carriers to be digitised again (including cleaning) because of possible
    - VTR trouble / process fault
    - Critical carrier
  - Comparison between file and original media only in case of doubt
    - Otherwise too expensive
Other aspects into account..

- How to find spare parts for obsolete equipments?
  An experimental approach..
- Do it yourself with 3D printing technology
- A solution that allows replacing broken parts meeting original specifications at reasonable prices
- Model either by CAD or by 3D Scanning

work on CAD

model from 3D scanner
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.. Sifting the archive..
Immediate exploitation vs long term span

Users
Working areas

Multimedia Catalogue
Documentation, search and selection interface

T3
Transition To Tapeless
file based digital production and archive environment

Old Archive Store Tapes and Films

Legacy store databases

DigiMaster
Input: tapes and films
Output: digital master files

XML

Input: tapes and films
Output: digital master files
Conclusions

- RAI directly takes care of its archive digitisation because of the strategic importance of this mission
- Archive preservation will not end with the full transition to files
  - Conversion to other file formats
  - Further metadata enrichment for better search and use
  - Digital restoration of valuable content
  - Evolution of storage and access technologies
- And the archive will grow with new, digital born productions

The DigiMaster team thanks for your attention