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POLO UNIVERSITARIO CITTÀ DI PRATO

Quality Management of 3D Cultural Heritage Replicas with CIDOC-CRM

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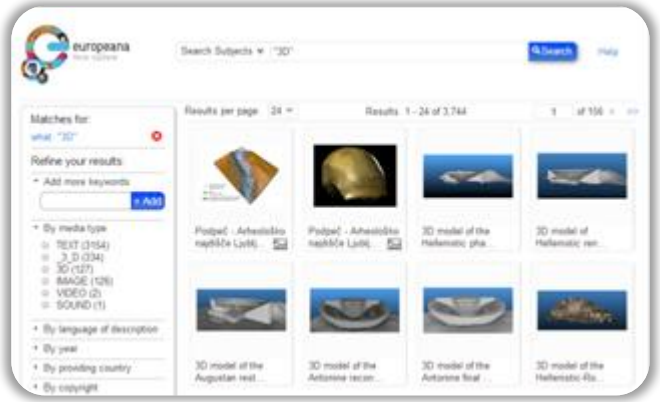
TPDL
17th International Conference on
Theory and Practice of Digital Libraries
Sharing meaningful information
September 22-26, 2013, Valletta, Malta

3D Digital Heritage

- 3D models are increasingly used in Cultural Heritage, thanks to the diffusion of technologies like laser scanning and photogrammetry that make 3D model widely available methodology.
- Nowadays it is being adopted for mass acquisition of artifacts and monuments, and 3D datasets are stored in an increasing number of openly accessible digital libraries.

e.g.: Europeana started to populate with 3D models of European art and to create tools for the creation of collections of digital replicas of cultural objects.



Project Aim

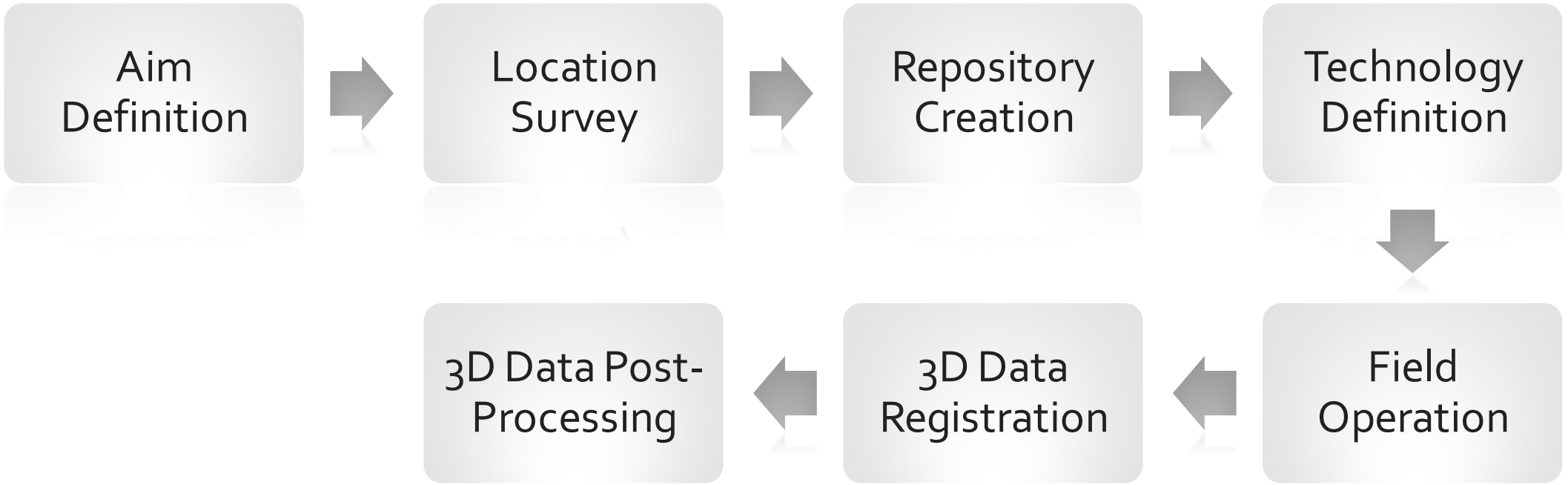
How can we verify the quality of a 3D model and its reliability?

- Documentation is crucial to assess trustworthiness and suitability for purpose and thus enable re-use.

CIDOC-CRM can help to this purpose?

- This research proposes to use CIDOC-CRM and its extension CRMdig to document the planning and execution of 3D models of cultural artifacts in order to manage the quality of the replicas

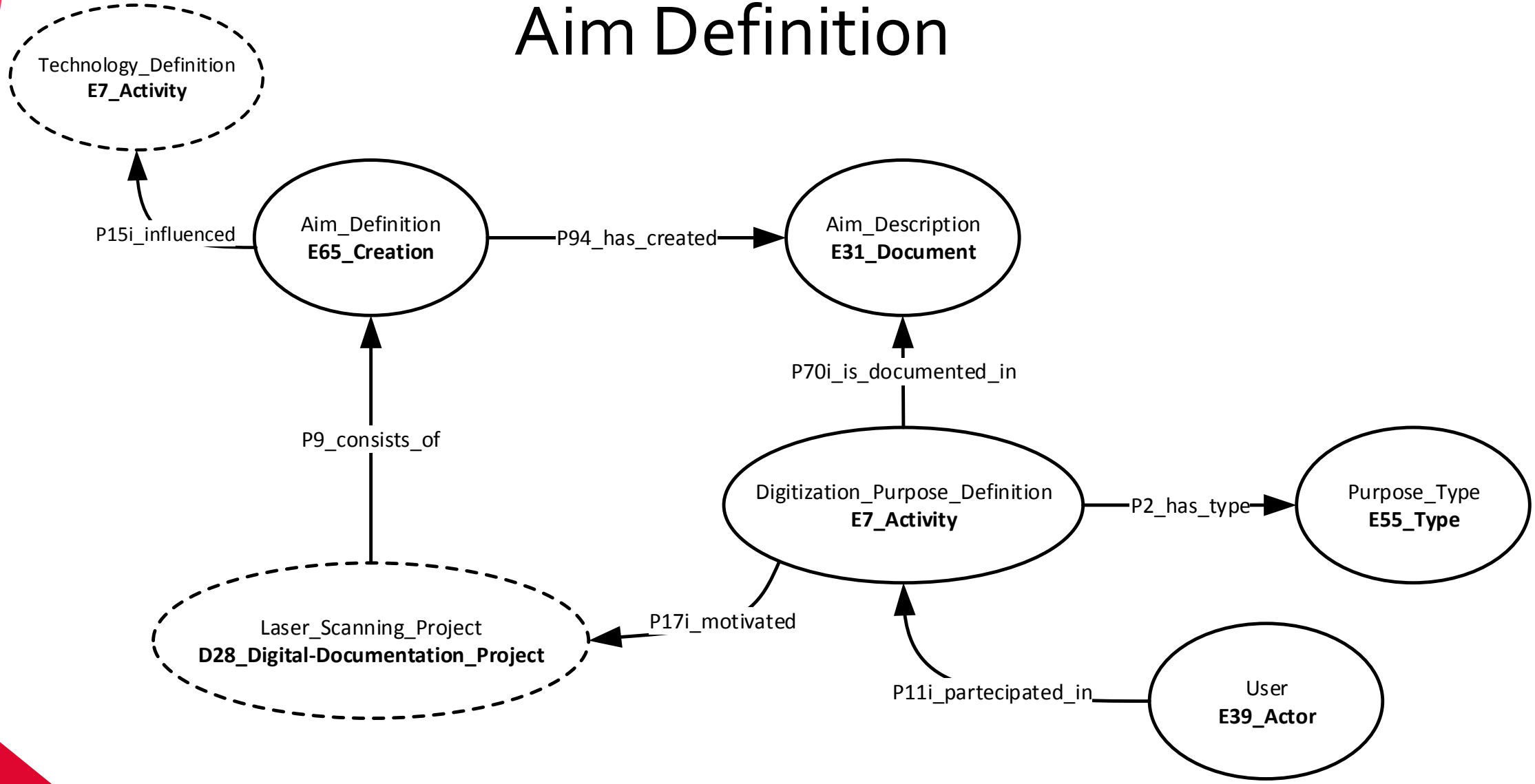
Laser Scanner Project Workflow



Aim Definition

- Aim Definition: define the purpose of the digitization
  - modeling for cultural documentation
  - production of virtual models for dissemination
  - creation of 3D models for virtual restoration
  - 3D printed replicas for dissemination (e.g. museum exibitions) and for research purposes
- The definition of the aim is strictly connected to the Technology Definition

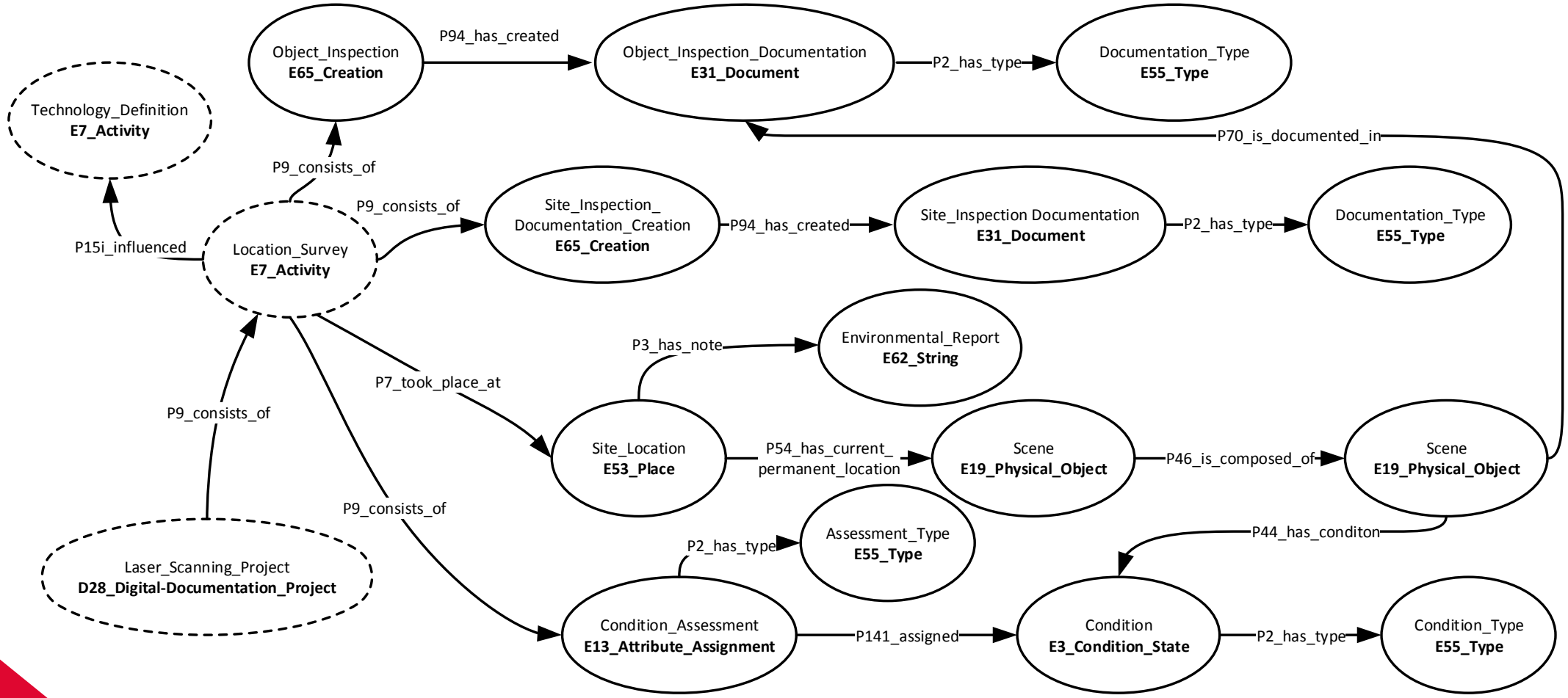
Aim Definition



Location Survey

- Location Survey concerns the inspection of
  - Environmental conditions
    - Lighting, temperature, presence of dust (indoor and outdoor) …
  - Object feature and size related to the surrounding scene
    - Location of monument or museum object (e.g. space available for scanning)
- This stage will support
  - In defining best time to collect the data
  - In identifying the presence of high reflective surfaces, obstructions and obstacles that may voids artifacts

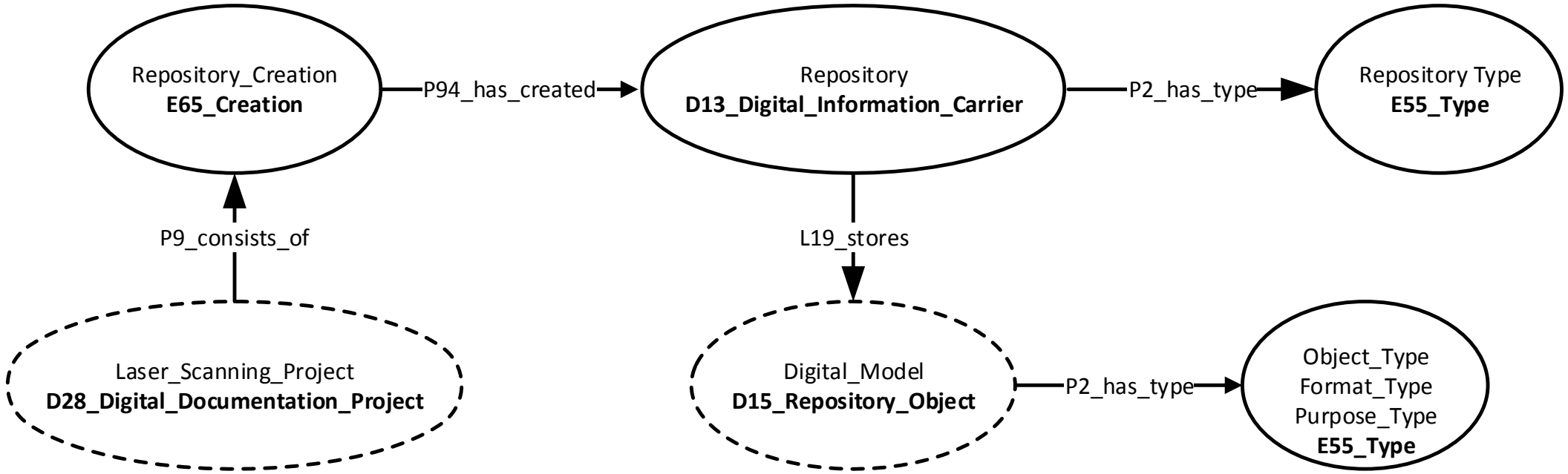
Location Survey



Repository Creation

- Repository design and creation: design the repository according to the project needs
  - The project may use an existing repository, if the work concerns models added to a previously existing one
  - Define correct file formats in order to save space and to guarantee interoperability

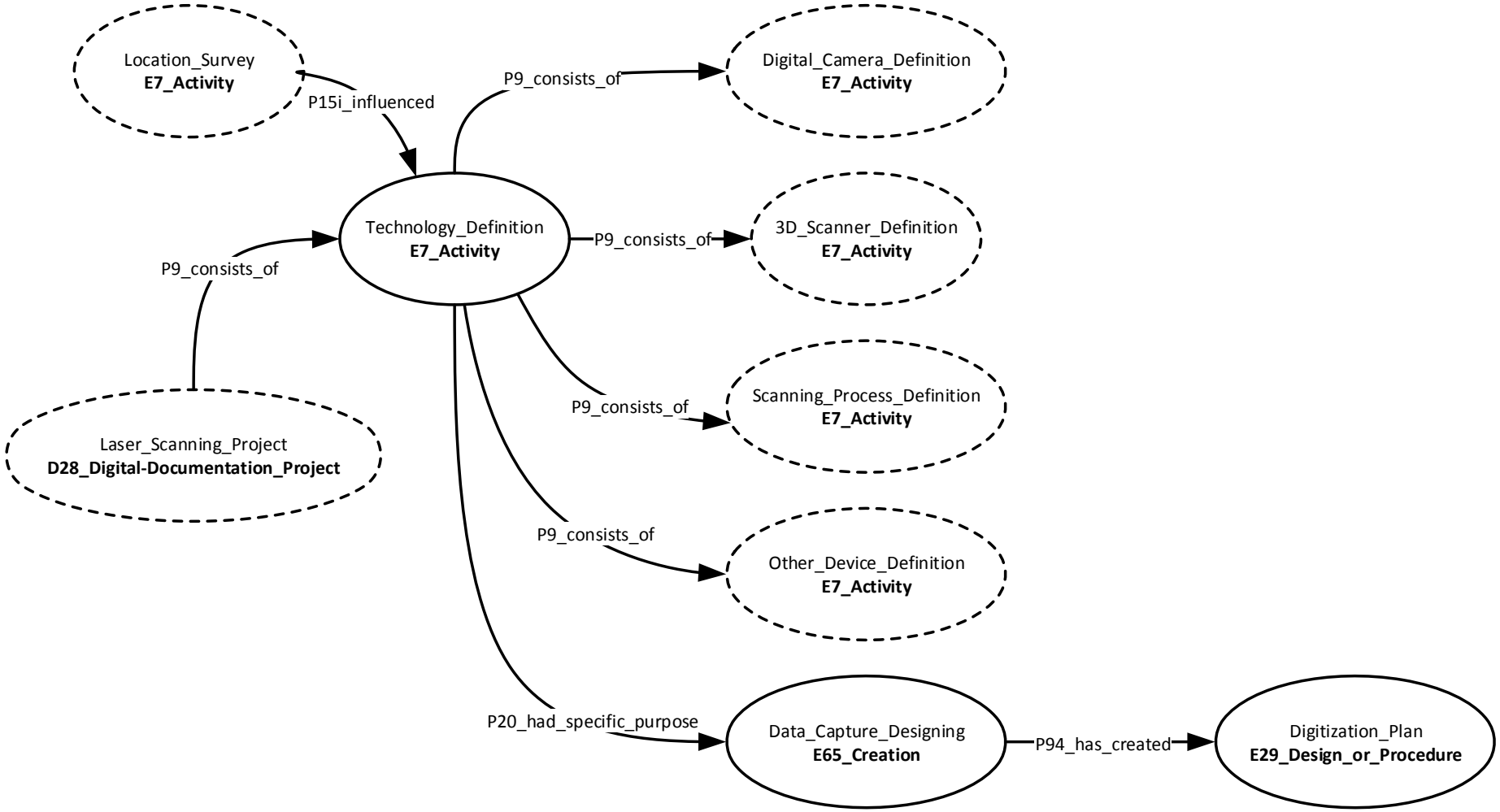
Repository Creation



Technology Definition

- The Technology Definition step concerns
  - Device features according to the location survey outcomes
    - Environment
    - Object material
    - Object shape
    - Object size

Technology Definition

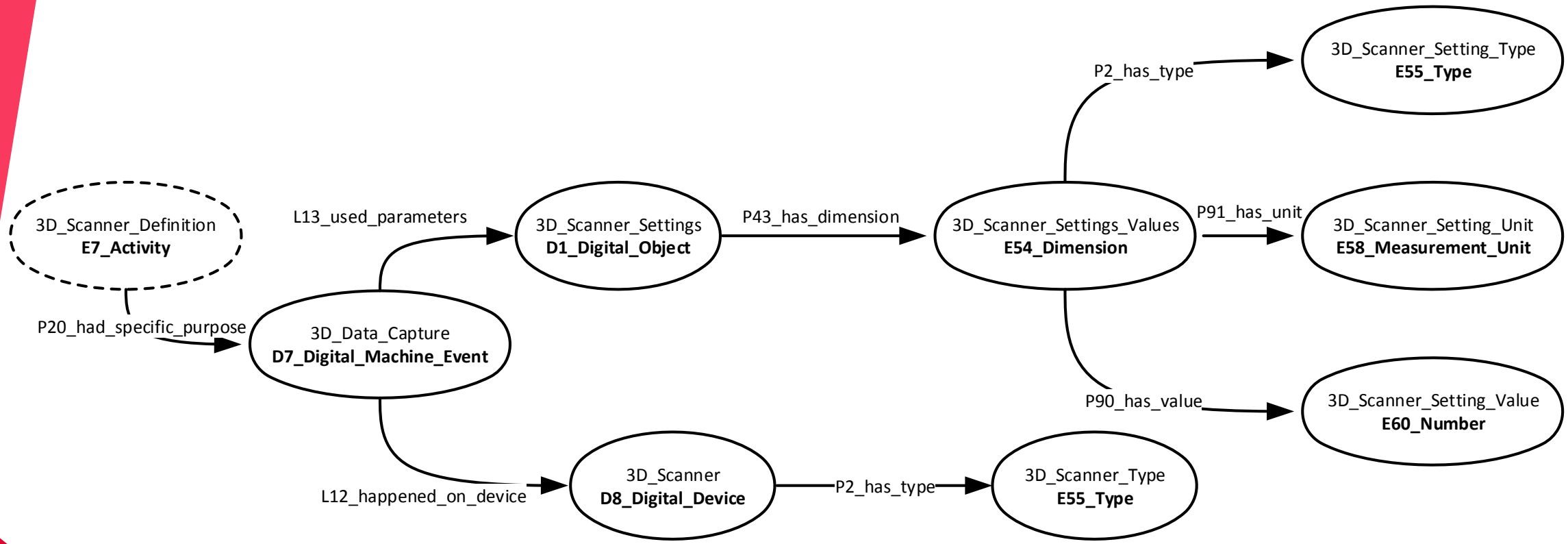


Field Operations

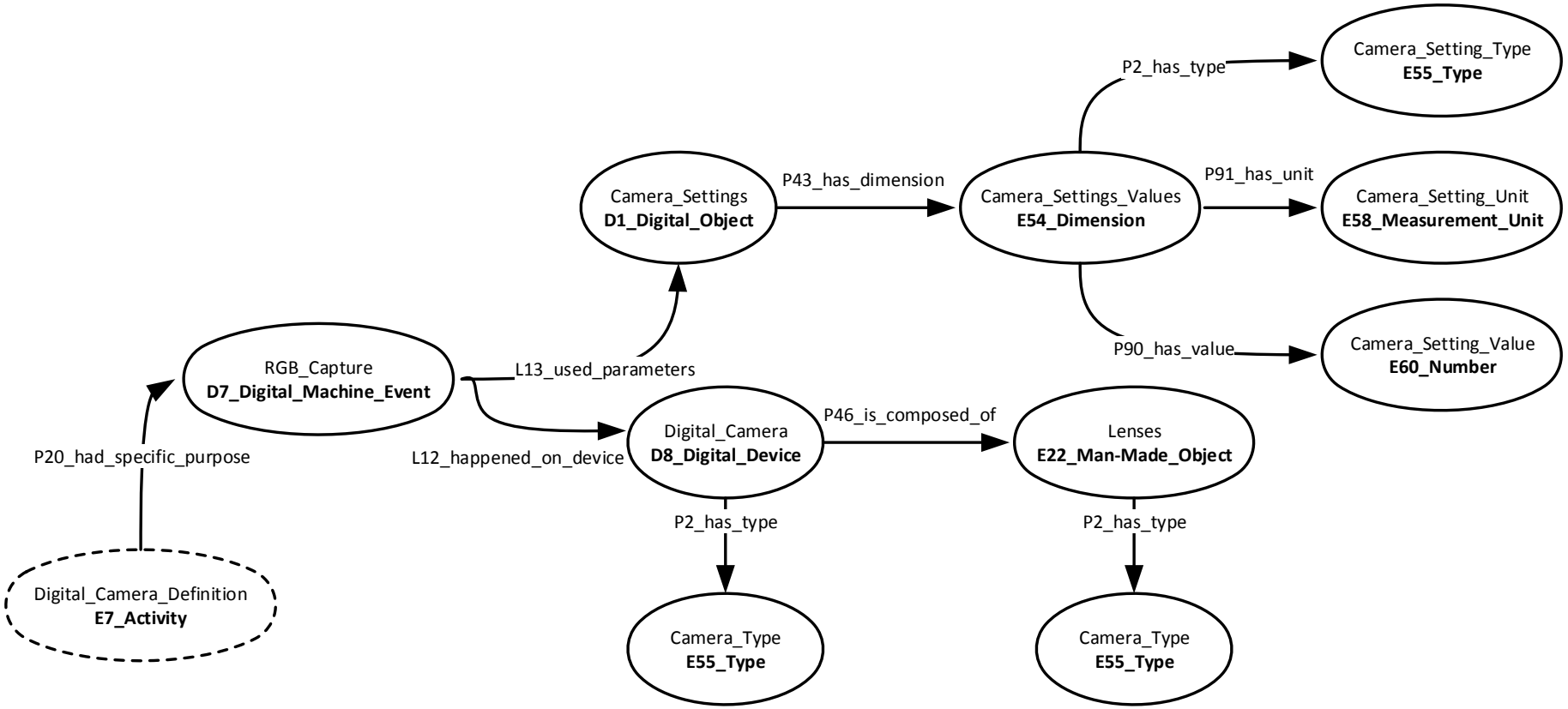
- The Field Operation step defines
  - Device features according to the location survey outcomes and to the object/scene to be scanned (FOV, level of detail)
  - Number of scan position (orientation angle)
  - Number and position of targets

- Total station and GPS
- Internal/external camera
- Set-up of lighting system (e.g. caves, museums)

Scanner Settings



RGB Capture


Camera_Setting_Type
E55_Type
P2_has_type
Camera_Settings
D1_Digital_Object
P43_has_dimension
Camera_Settings_Values
E54_Dimension
P91_has_unit
Camera_Setting_Unit
E58_Measurement_Unit
P90_has_value
Camera_Setting_Value
E60_Number
RGB_Capture
D7_Digital_Machine_Event
L13_used_parameters
Digital_Camera
D8_Digital_Device
P46_is_composed_of
Lenses
E22_Man-Made_Object
P20_had_specific_purpose
L12_happened_on_device
P2_has_type
P2_has_type
Digital_Camera_Definition
E7_Activity
Camera_Type
E55_Type
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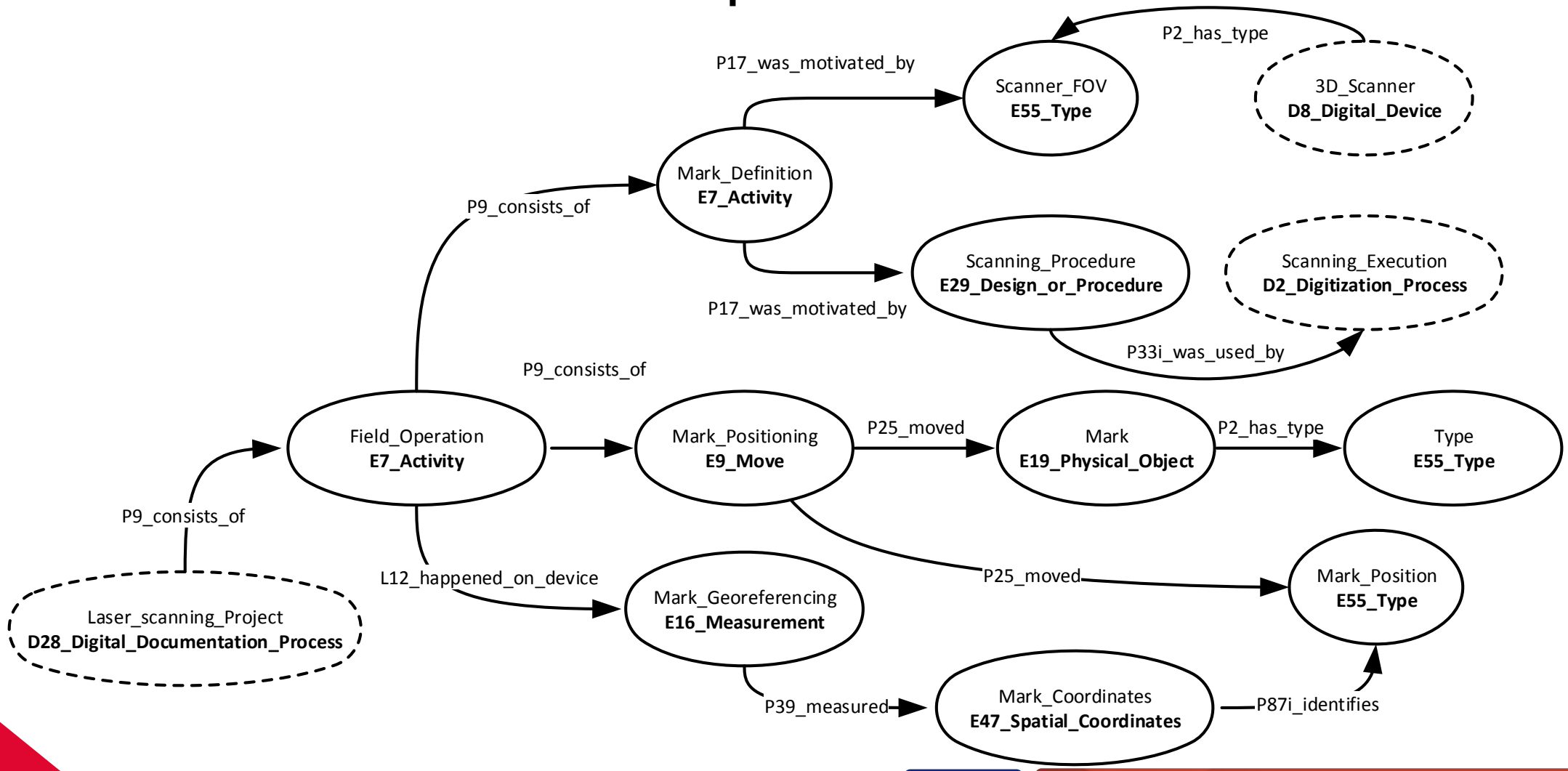
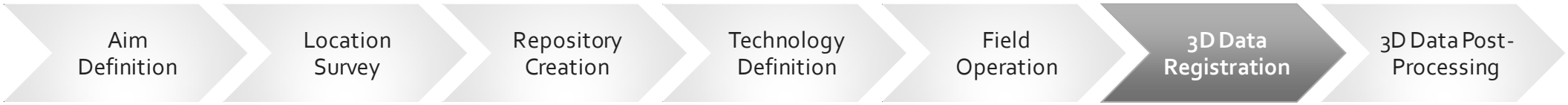
Field Operations

Field Operations

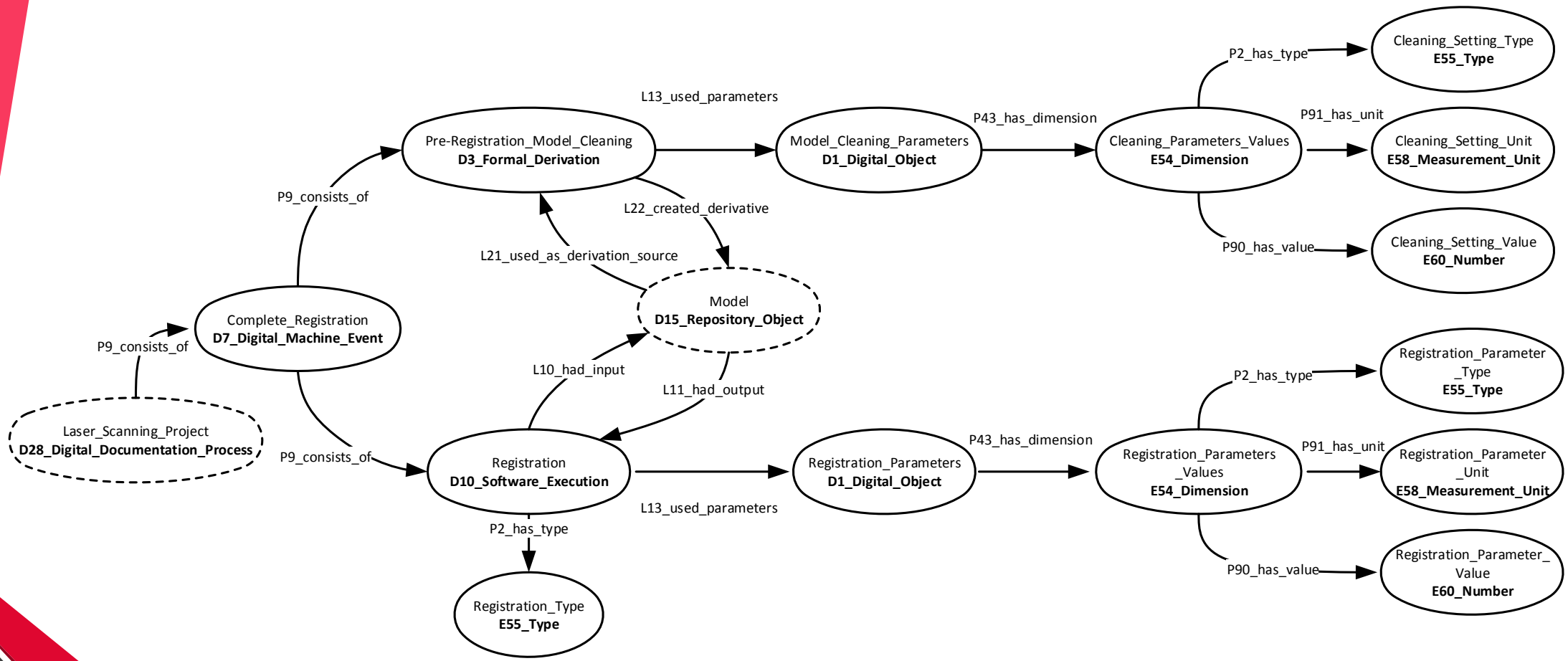


3D Data Registration

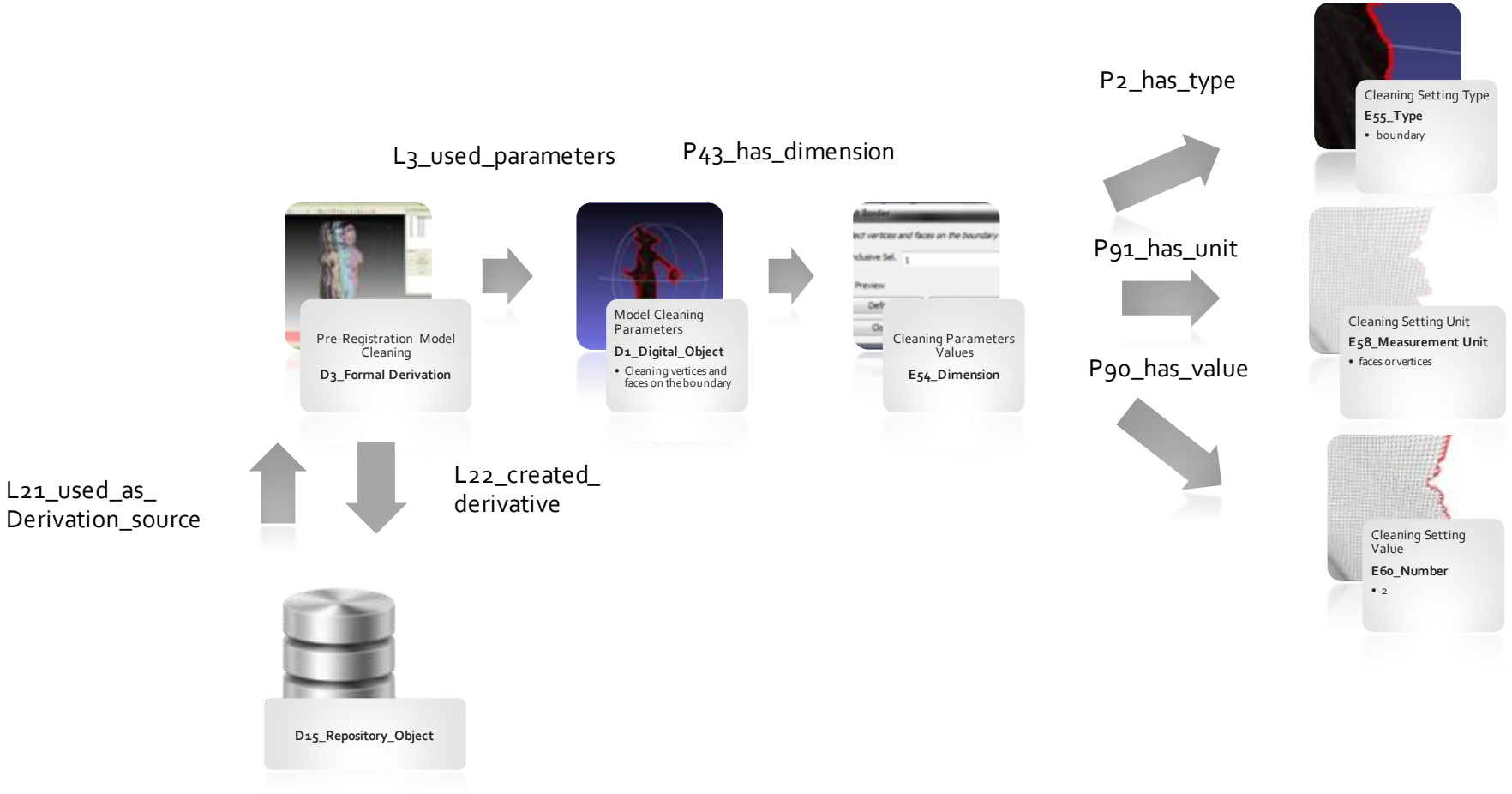
- The 3D Data Registration consists of merging multiple scans with each other in correct, relative 3D geometry within a single coordinate system. It includes:
  - Scanner position
  - Ground Control Points (GCPs) or identifiable features
- Pre-registration cleaning: remove noisy data, which could affect the final result.



3D Data Registration



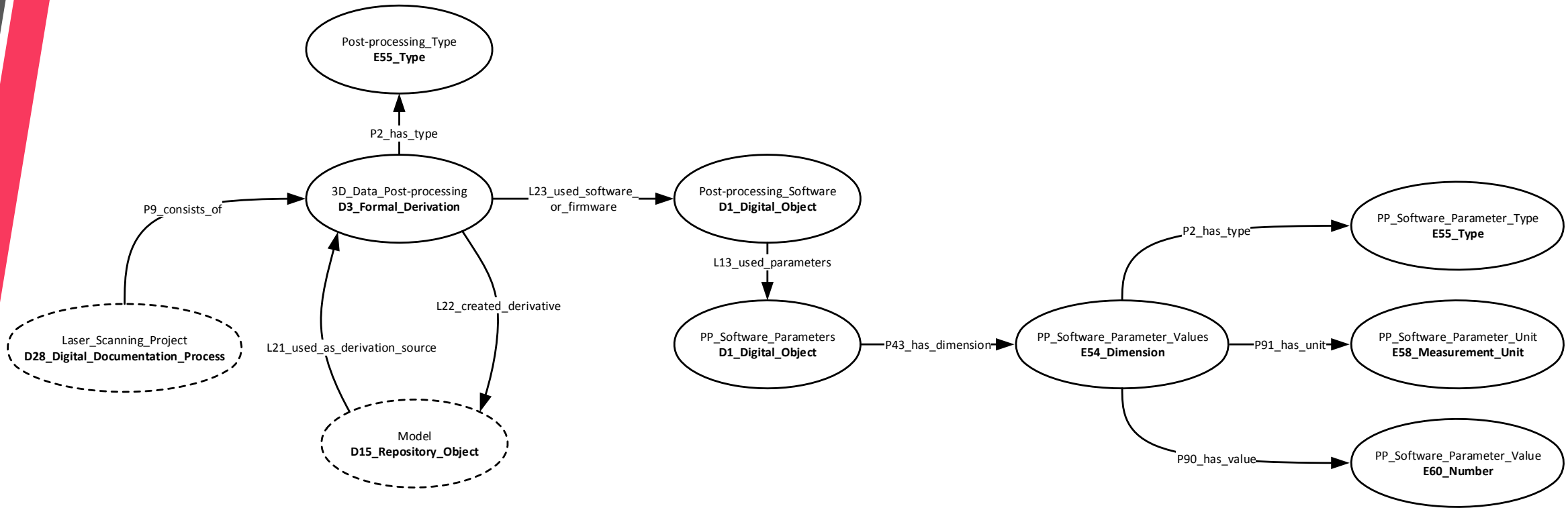
Pre-Registration Cleaning



3D Dataset Post-Processing

- The Post-Processing step includes
  - Polygonal mesh generation
  - Cleaning processes
  - Resampling and decimation

3D Dataset Post-Processing



Conclusions and Future Works

- This research illustrates how CRM may support Quality Management of 3D Cultural Heritage documentation
- It is being extended to other methodologies like photogrammetry/SfM, videogrammetry
- It may need refinements and revisions dictated by practice
- Implementation will need tools to simplify the input
- The procedure is being tested within a 3D digital library project

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Thank you for your attention

ARIADNE is a project funded by the European Commission under the Community's Seventh Framework Programme, contract no. FP7-INFRASTRUCTURES-2012-1-313193. The views and opinions expressed in this presentation are the sole responsibility of the authors and do not necessarily reflect the views of the European Commission.

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