# Color Imaging Workflow Primitives: Executive Summary

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# Color Fidelity



The term "color fidelity" refers to the successful interoperability of color data, from image creation to output across multiple targets, such that color reproduction quality consistent with the user's intent can be achieved

- Interoperability among system color components, necessary for color fidelity, is both color-workflow and market-segment dependent
- No limited defined set of workflows can be prescribed that will be sufficient for all cases
- Rather, the approach is to define a small set of workflow primitives, i.e., workflow building blocks, that can be assembled in a variety of ways, and when aggregated, can be used to describe all workflows in standard terms

# Color Control (ICC) Architecture

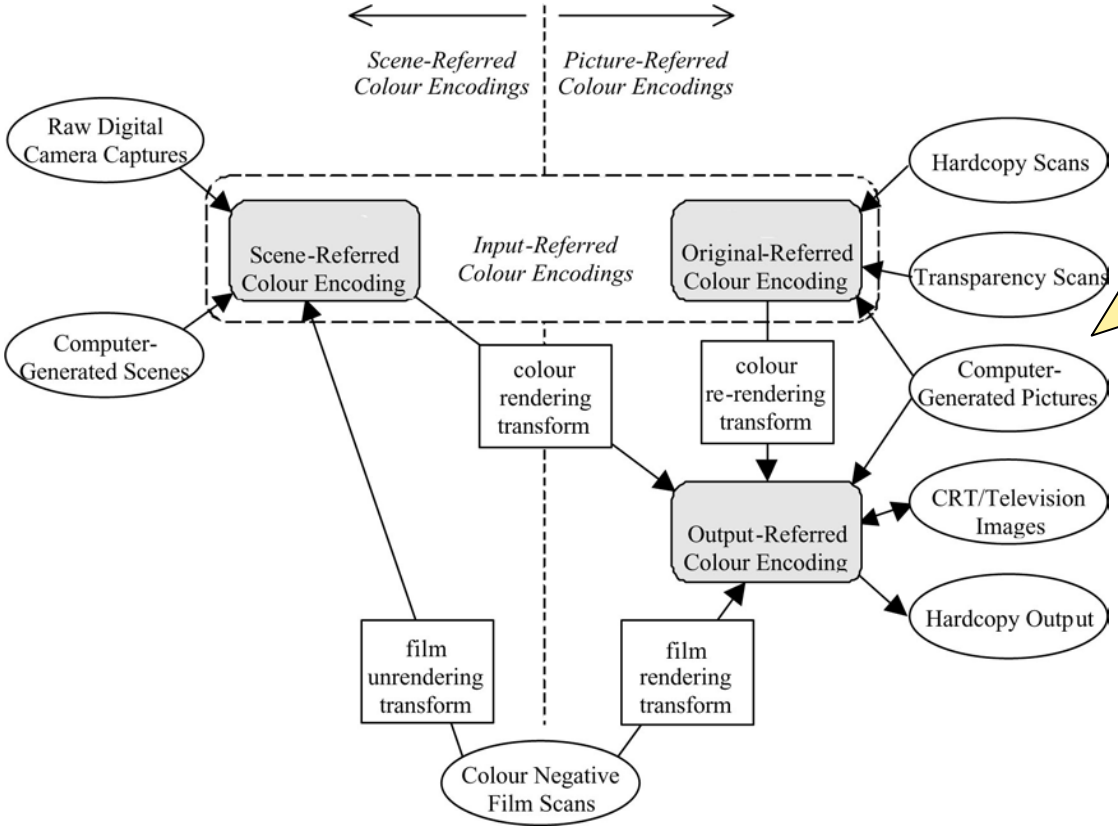


- Device calibration — *Color Calibration*
  - Alters the color response of a device to return it to a known state
- Capture and visualization characterization — *Color Characterization*
  - Describes the color response of an input or output condition
- Profile creation — *Color Aim Implementation*
  - Encodes a characterization and a color aim for use in a transform
- Image color encoding — *Color Source Specification*
  - Unrendered (e.g., capture a scene) vs. color-rendered (targeted)
- Profile selection and exchange — *Color Communication*
  - Profiles can be embedded with an image or document, or can be transmitted as separate files
- Profile use — *Color Transformation*
  - Profiles are applied in pairs to transform an image from a current encoding (the source) to another encoding (the destination)
- Visualization – the human element — *Color Aim Expectation*
  - What does the human expect?

# Definitions



- Image state
  - The degree to which image data has been constrained or purposed to a particular visualization mechanism, as compared to the degree to which the image data has been retained unaltered with respect to its capture condition




Concepts of scene-referred, original-referred, and output-referred image state as shown in ISO CD 22028-1-Part 1

ICC workflows include both Actual Output Referred (a particular visualization device) and Reference Output Referred (e.g., SWOP)

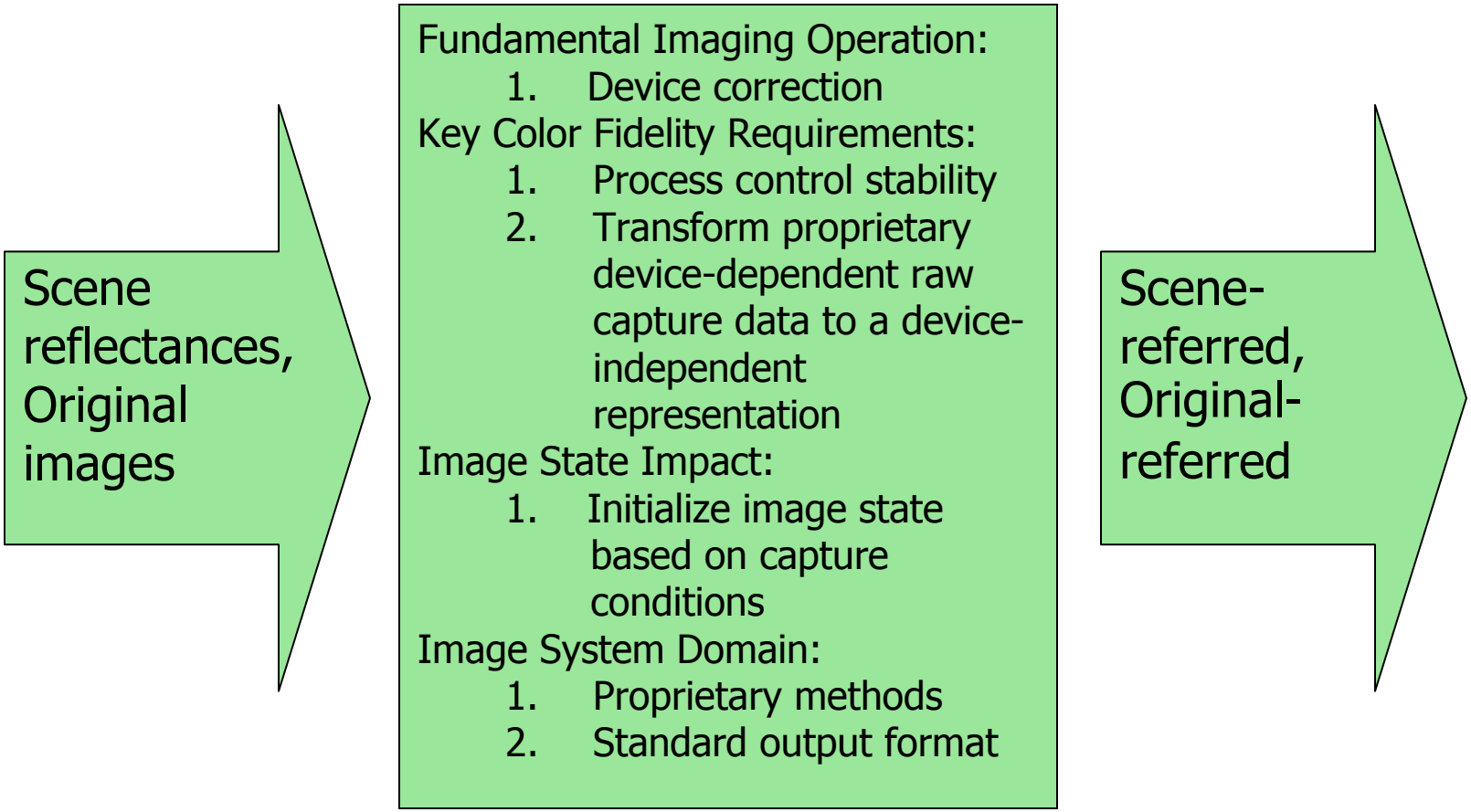
# Definitions



- 'Scene-Referred image data' (SR)
  - Image data that unambiguously encodes the spectral reflectances of the scene (including scene-capture tristimulus encodings)
- 'Original-Referred image data' (OR)
  - Image data that unambiguously encodes a computer-generated or hardcopy original
- 'Reference-Output-Referred image data' (ROR)
  - Output-referred image data that is color-rendered to a standardized output (i.e., an output that is defined through an ideal specification - a precise, arbitrary, output definition that may or may not be realizable)
- 'Actual-Output-Referred image data' (AOR)
  - Output-referred image data that is color-rendered to a specific, particular, realizable device, e.g., encoding the intended color appearance of an image as it is to be printed
- Four fundamental image processing operations
  - Correction operations: 'Corrections' are operations that are required based on device limitations or anomalies
  - Appearance operations: perform input to output environment specific adaptation operations
  - Preference operations: deal with intentional alterations of appearance to increase the aesthetic value of an image and may be image and visualization specific
  - Gamut mapping operations: map the co-ordinates of the elements of a source image to the co-ordinates of the corresponding elements of a destination image, compensating for differences in the source and output color gamut volume and shape

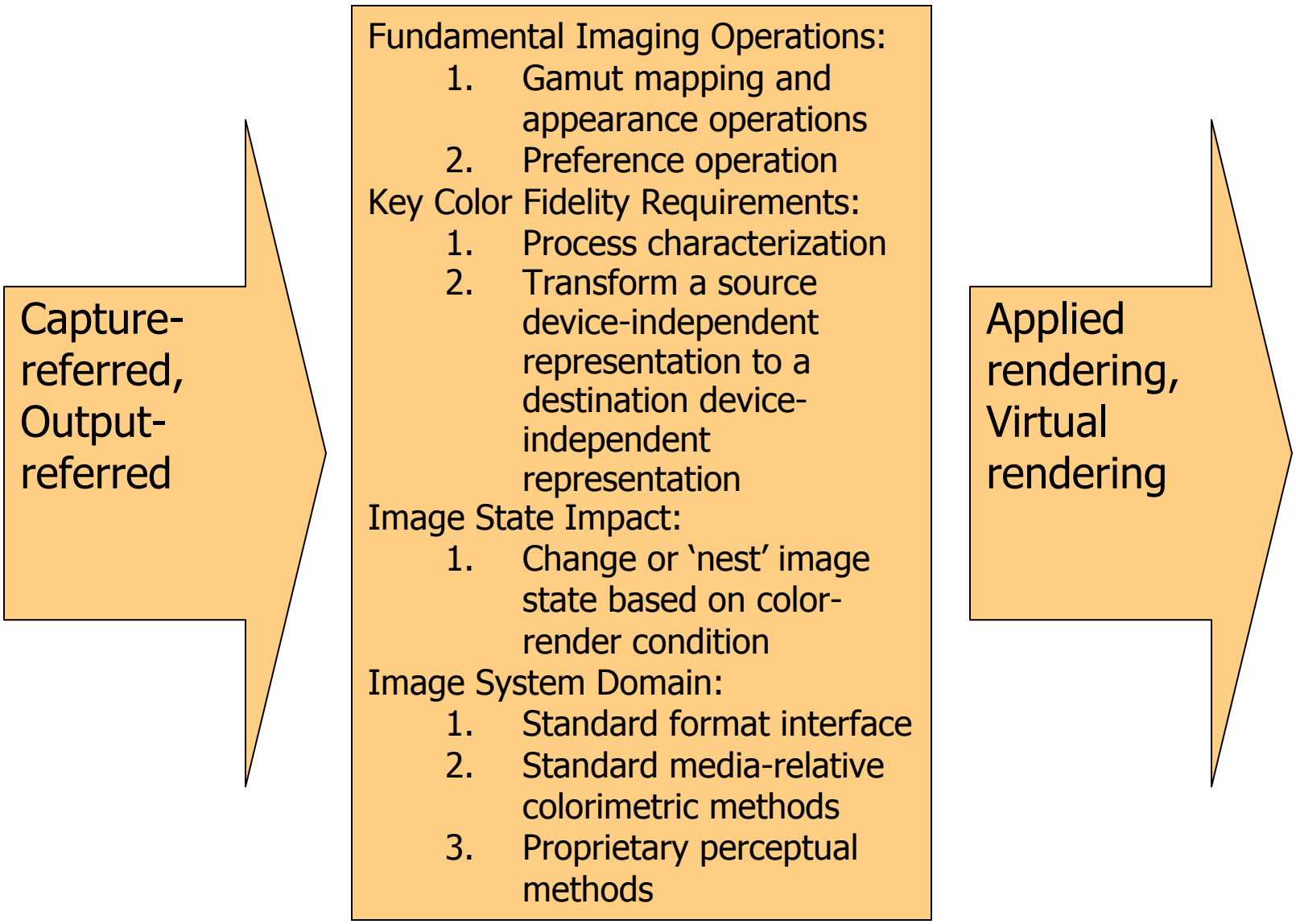
# The Capture Workflow Primitive





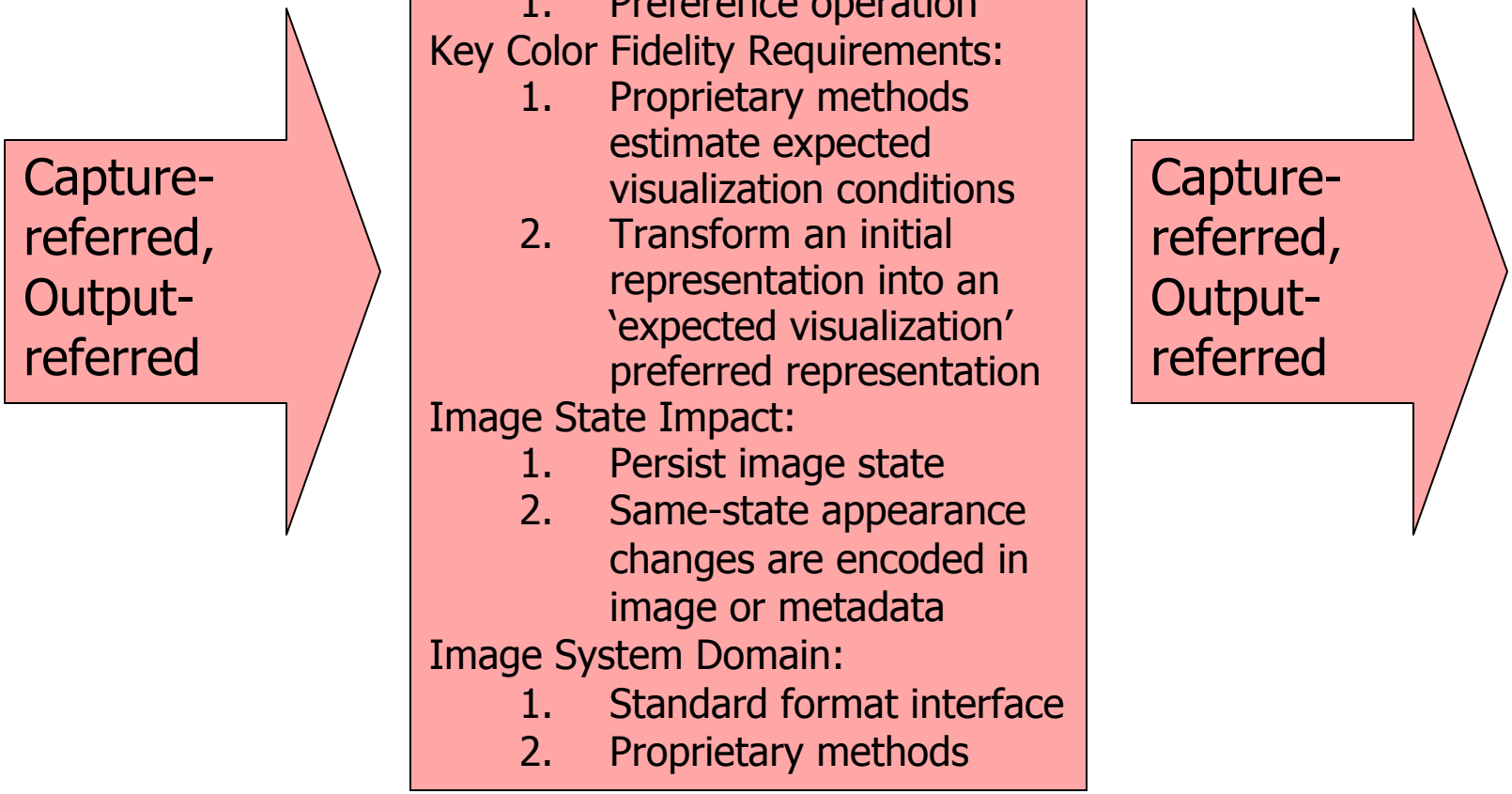
# The Color-Render (CMM) Workflow Primitive





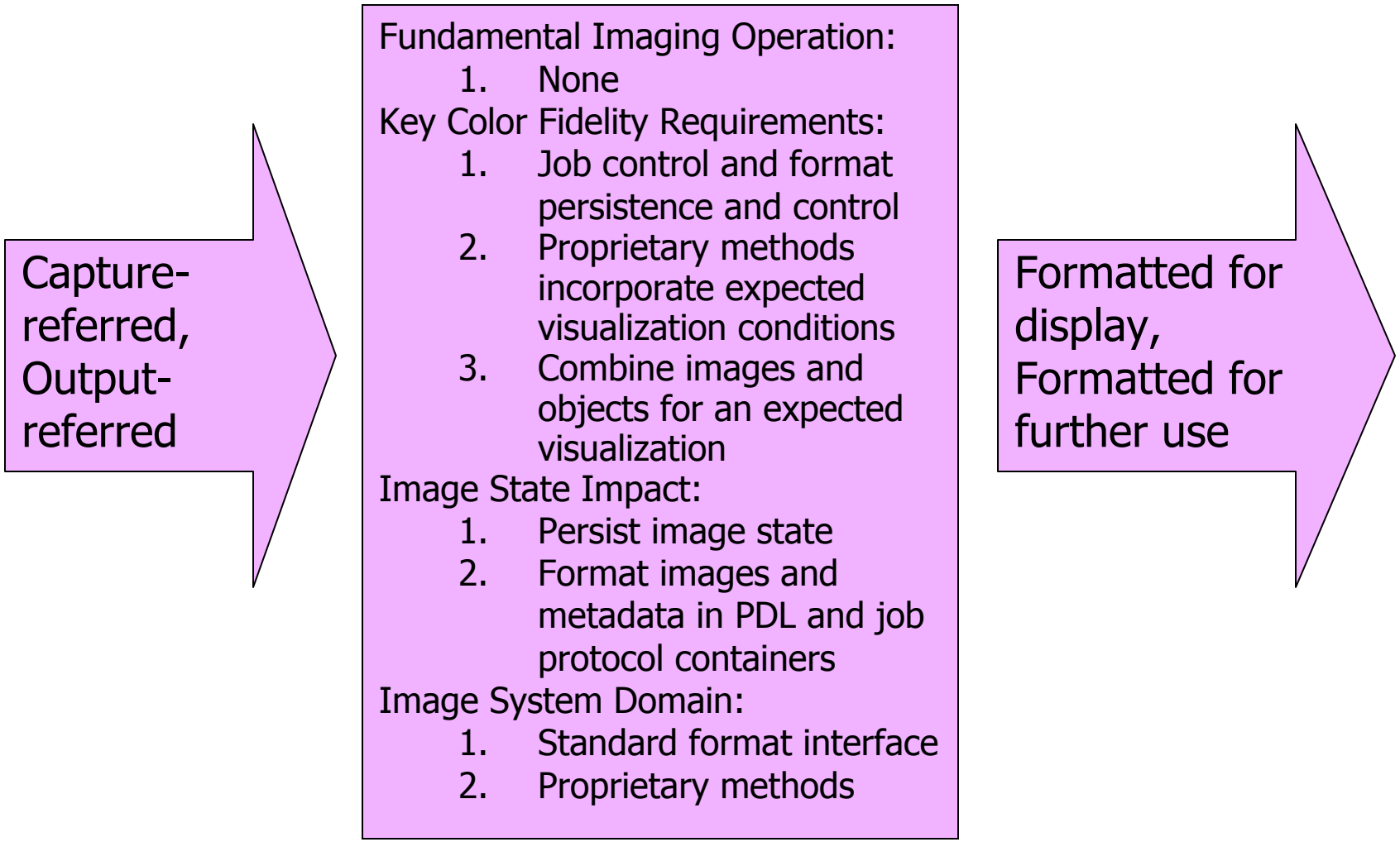
# The Adjust Image/Object Workflow Primitive





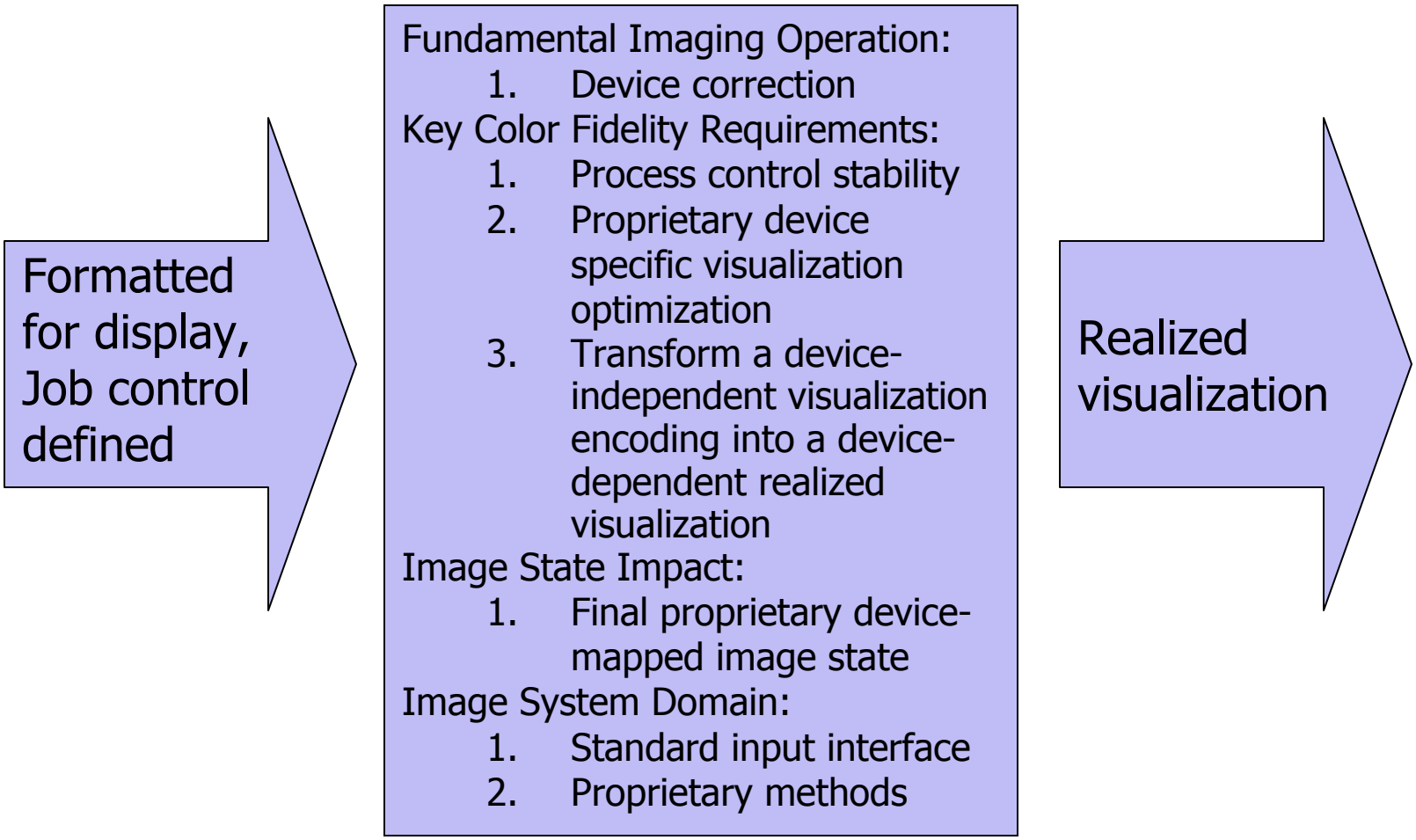
# The Assemble Object/Entity Workflow Primitive





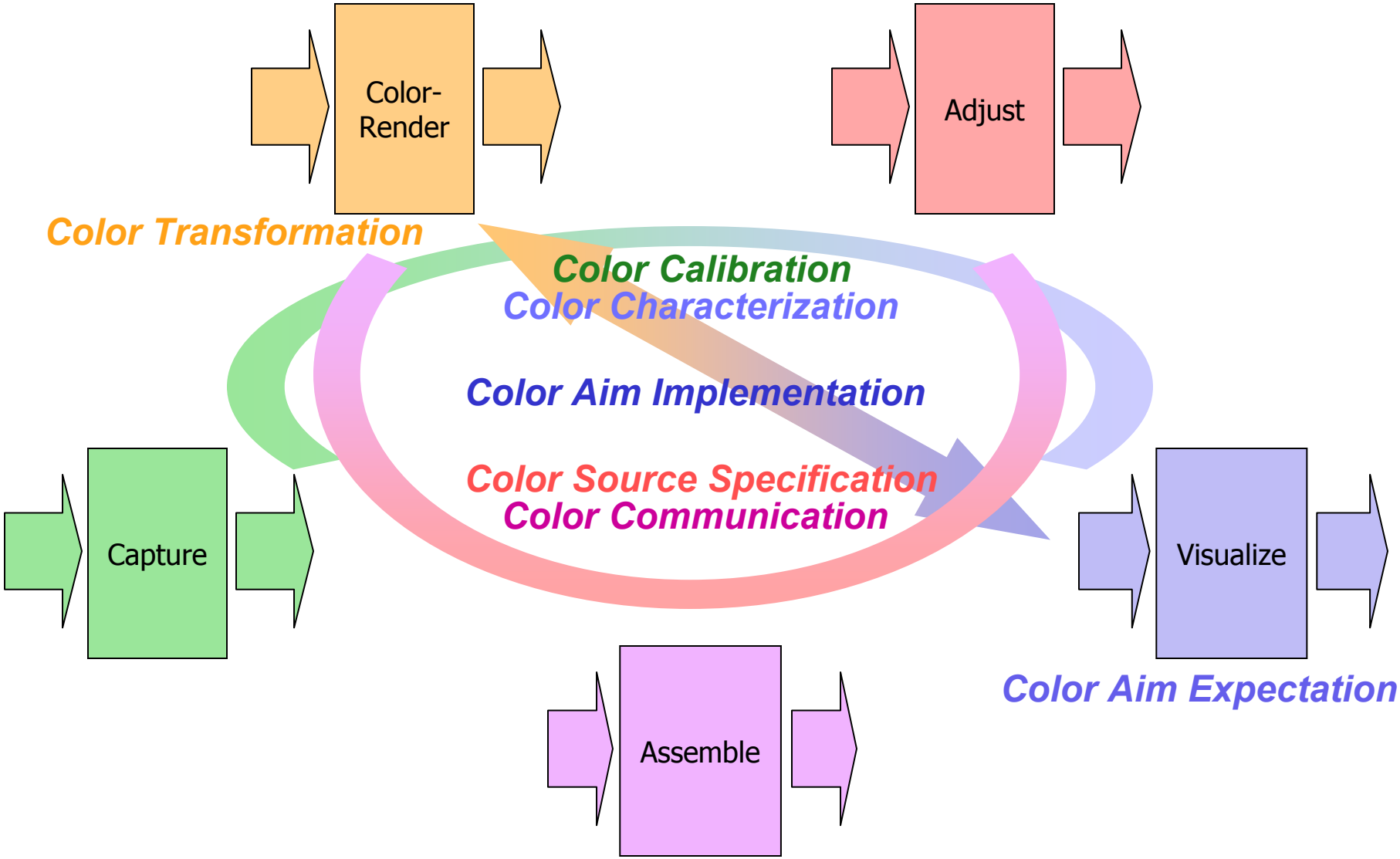
# The Visualization Workflow Primitive





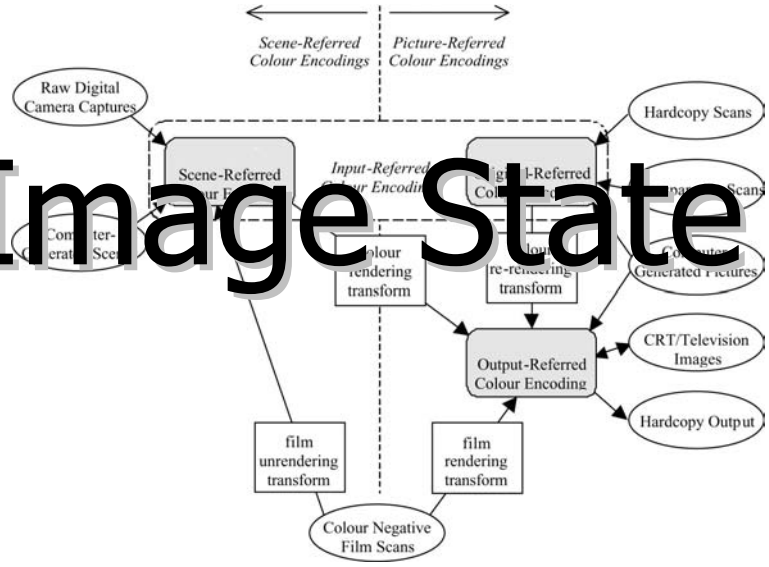
# Workflow Functional Primitives Depend on the Color Control Architecture





# Four Meta-Systems Deliver Color Fidelity






## Image State

## Workflow Primitives

Color Transformation

Color Calibration

Color Characterization

Color Aim Implementation

Color Source Specification

Color Communication

Color Aim Expectation

## Color Control Architecture


Surplus may fund retreat center

UPD enforces

## Formats & Protocols