



**Path tracing, Distributed ray tracing,
Stochastic ray tracing, Monte Carlo ray
tracing, Photon mapping, Bidirectional ray
tracing, . . . OH MY!**

John A. Thywissen

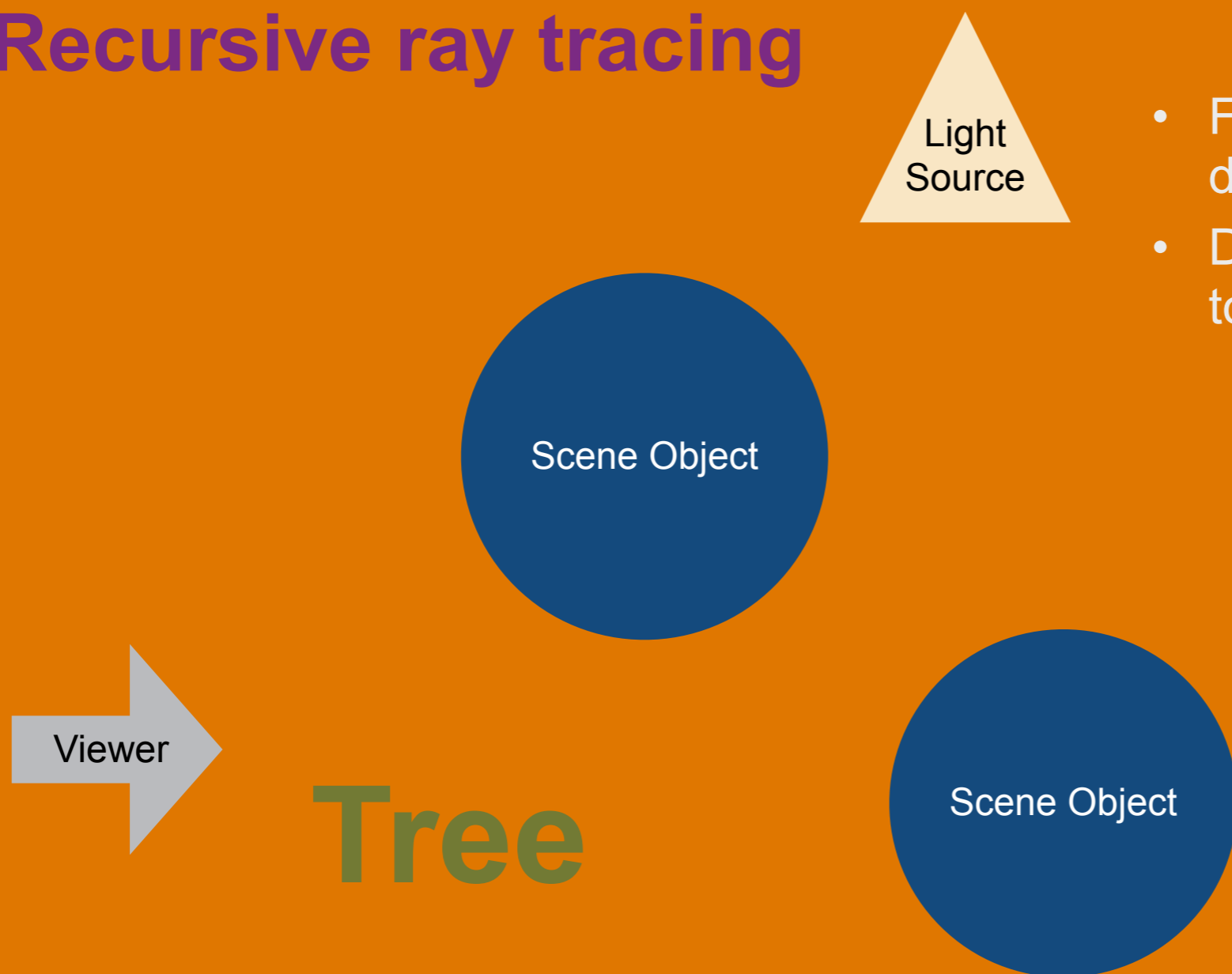
04 Dec 2008

CS 384G, Fall 2008, Prof. D. Fussell
Department of Computer Sciences
The University of Texas at Austin



Trees vs. Paths

Recursive ray tracing

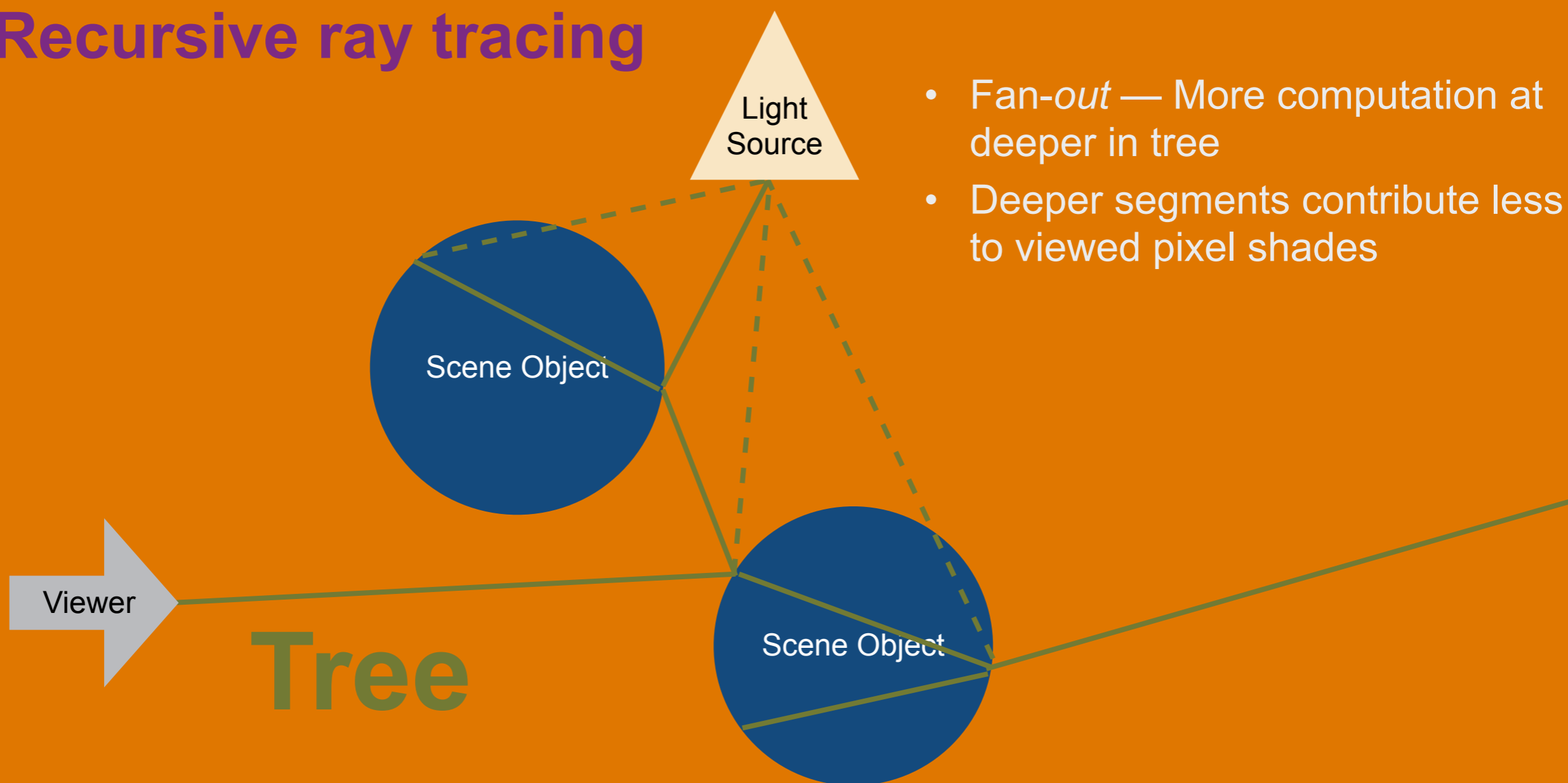


- *Fan-out* — More computation at deeper in tree
- Deeper segments contribute less to viewed pixel shades



Trees vs. Paths

Recursive ray tracing

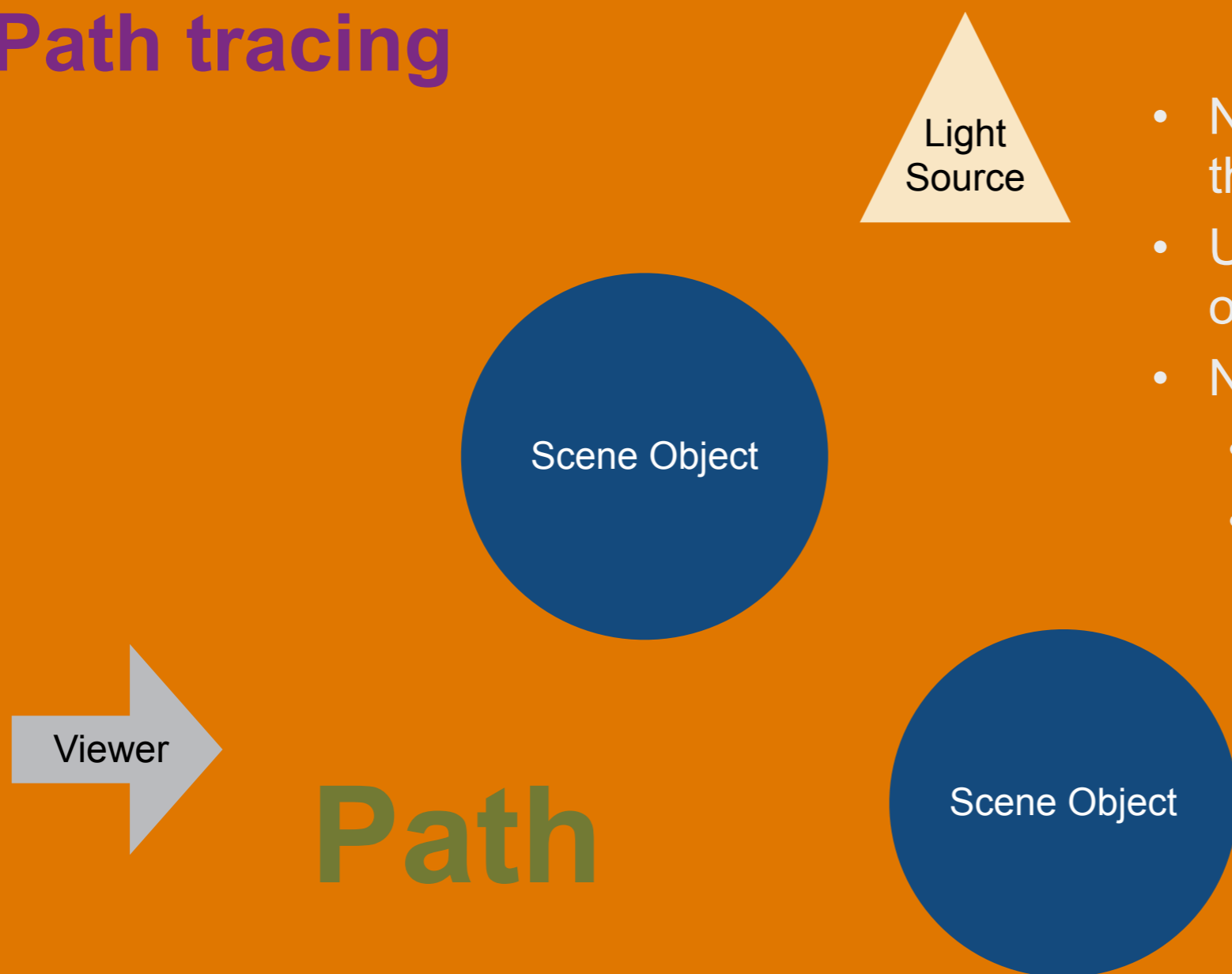


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Trees vs. Paths

Path tracing

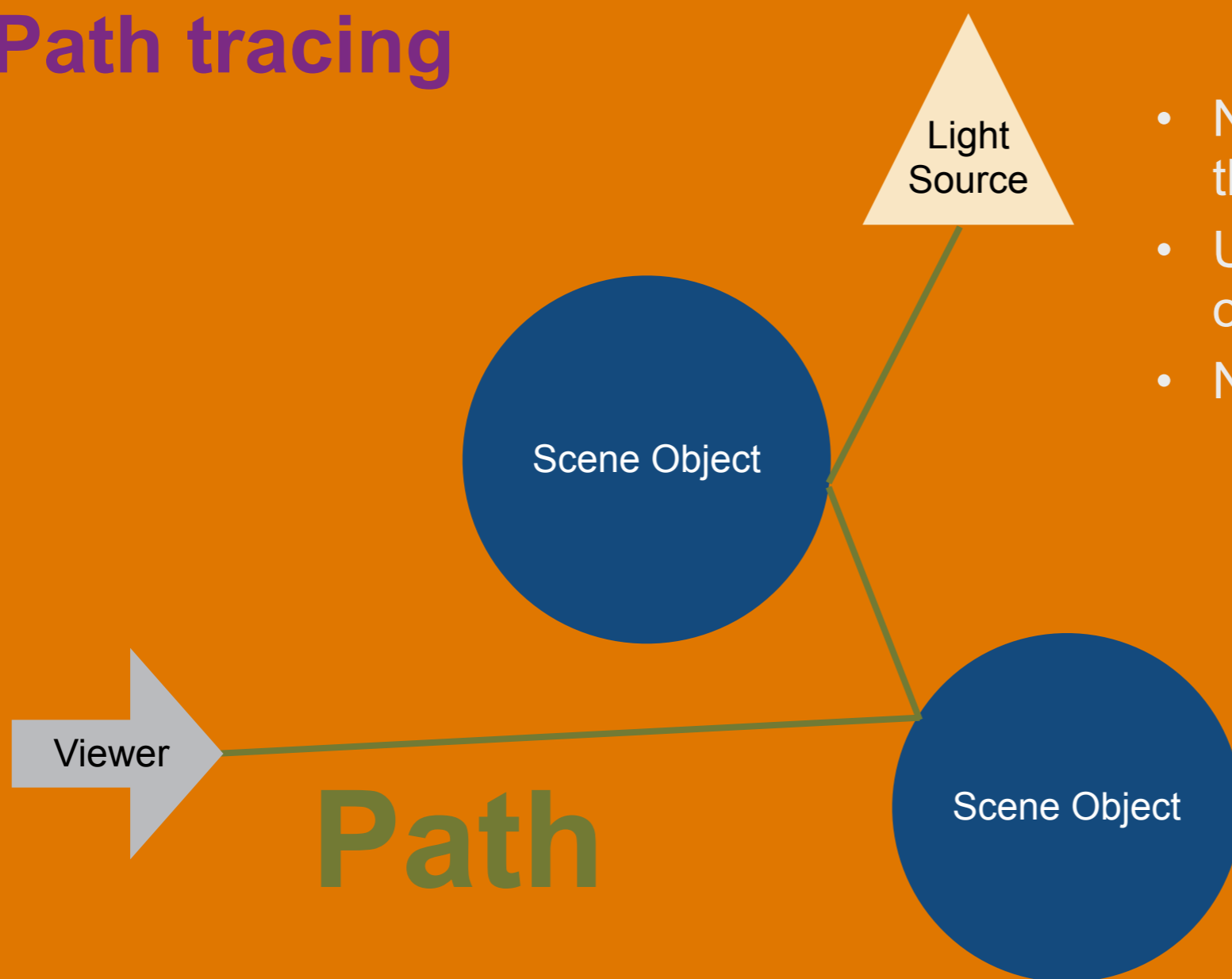


- No fan-out — sampling rooted at the viewed pixel level
- Use *much* more (up to two orders of magnitude) sub-pixel sampling
- Need to be smart about:
 - Weighting samples
 - Picking direction to branch



Trees vs. Paths

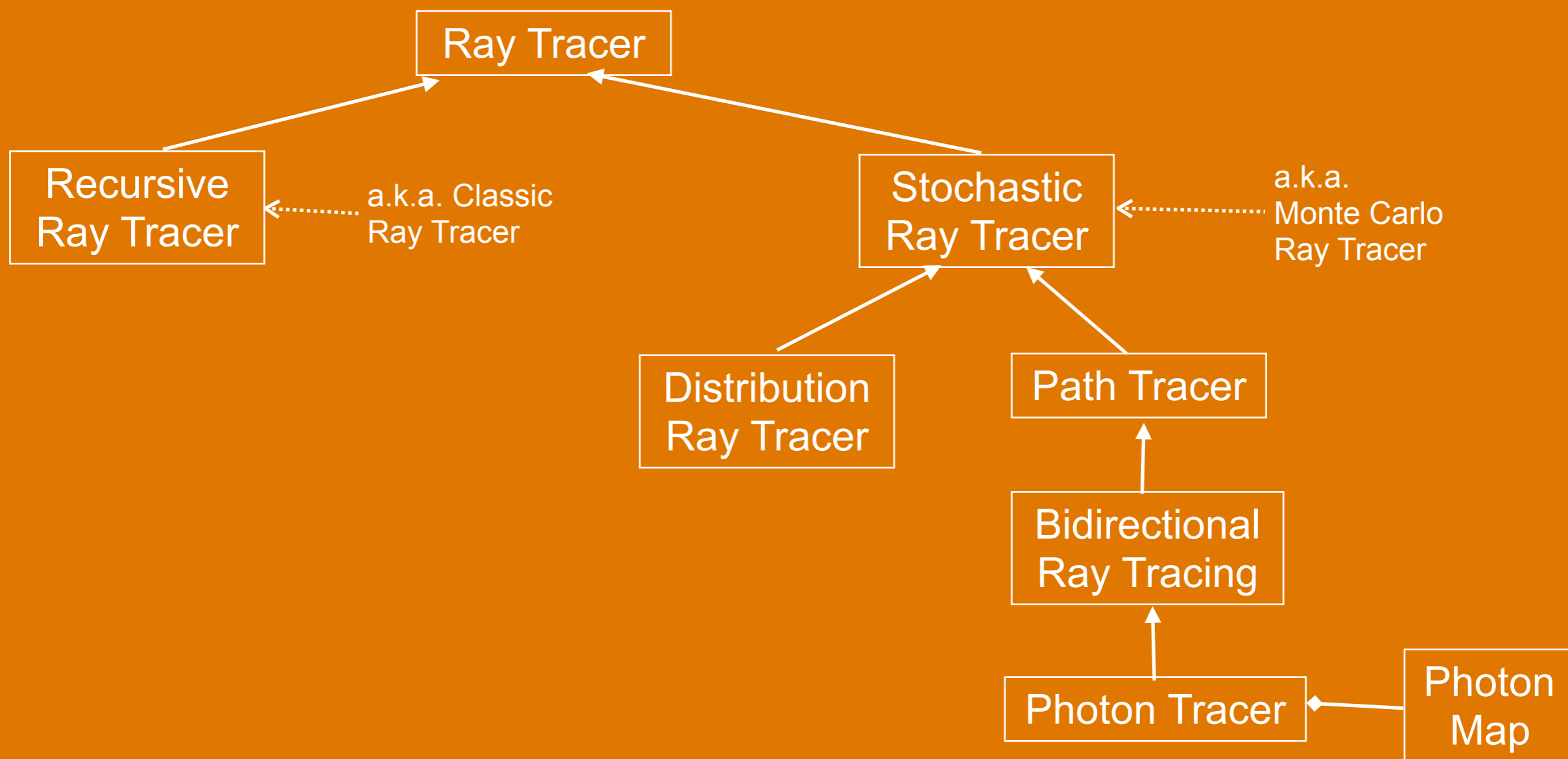
Path tracing



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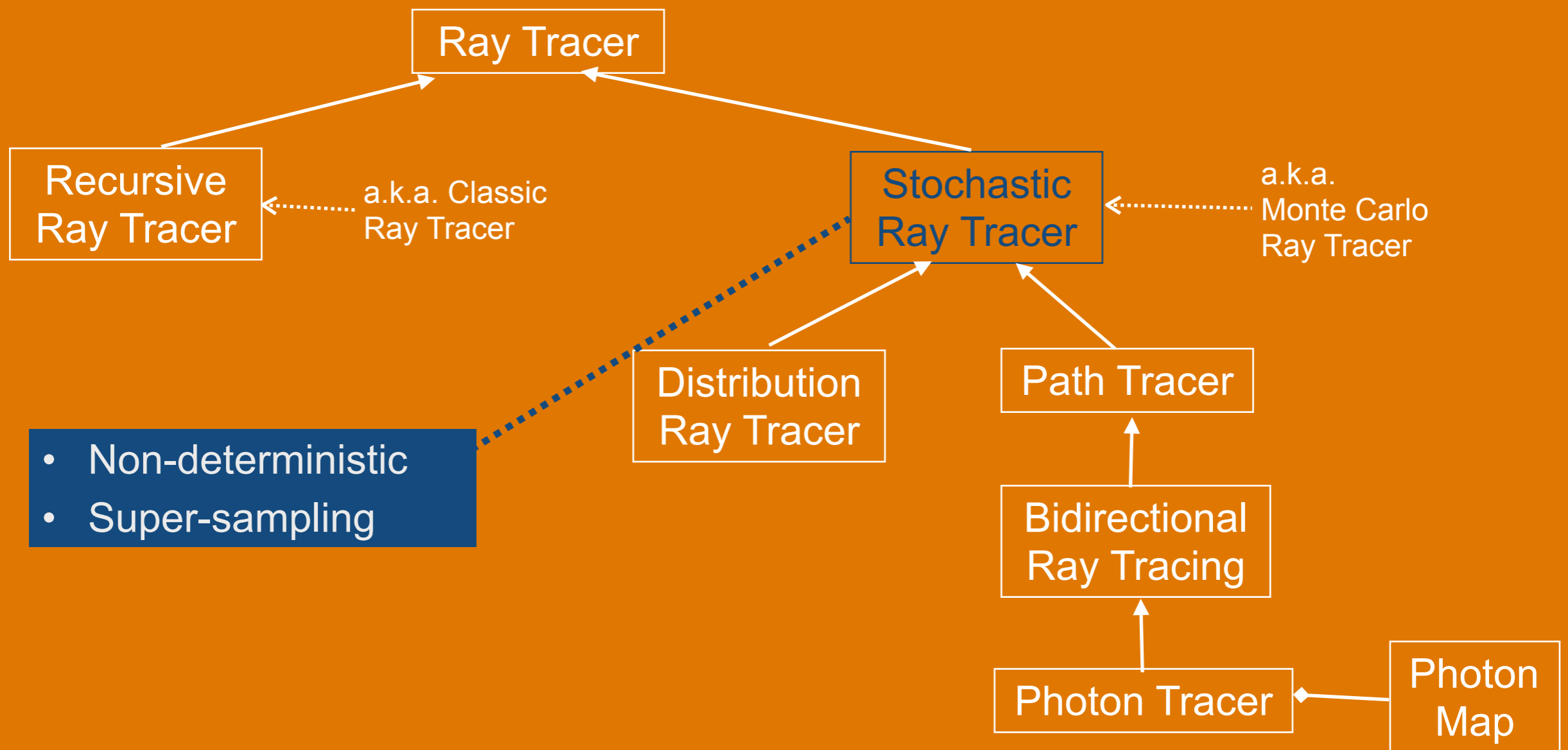


Ray Tracing Type Hierarchy



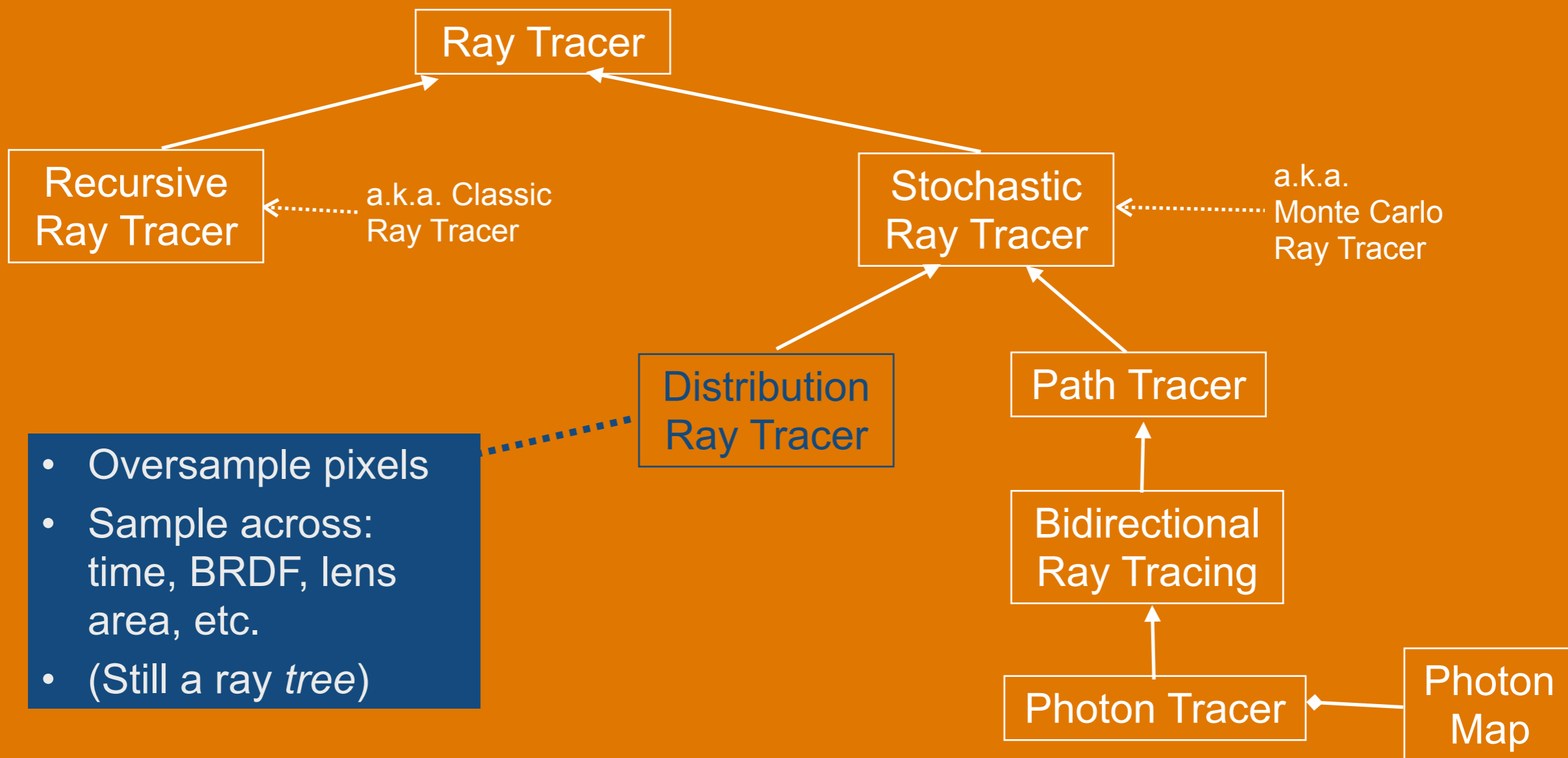


Ray Tracing Type Hierarchy



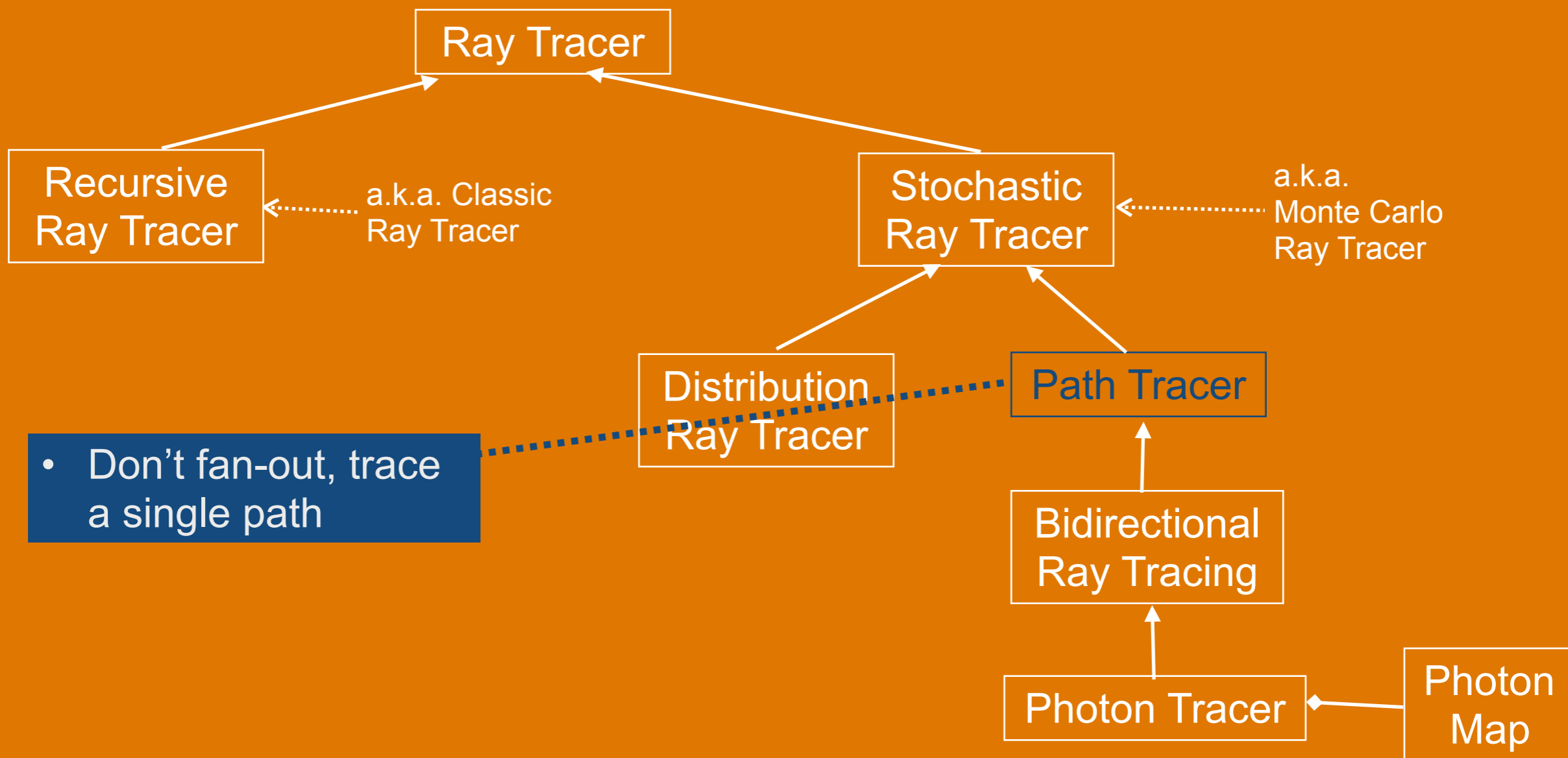


Ray Tracing Type Hierarchy



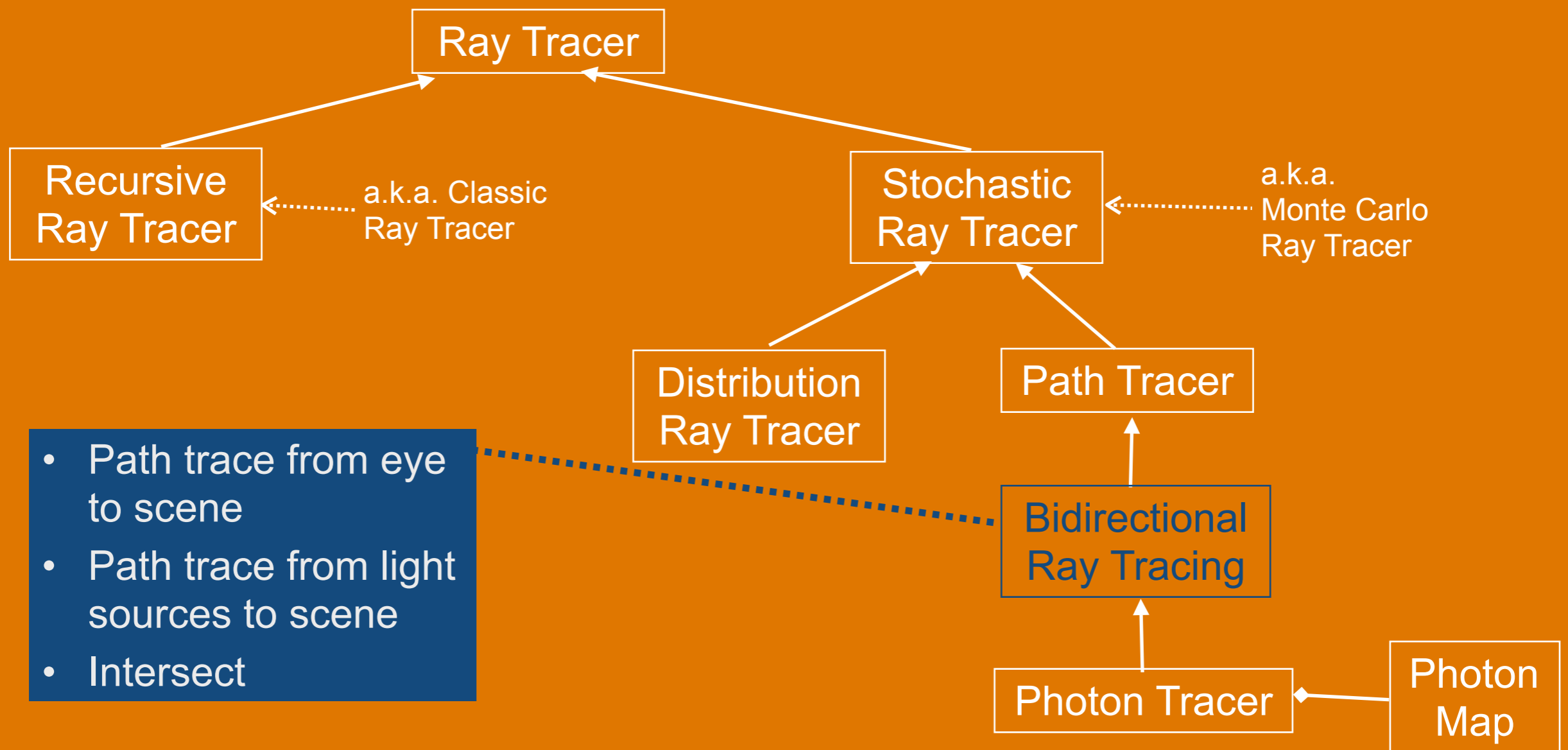


Ray Tracing Type Hierarchy





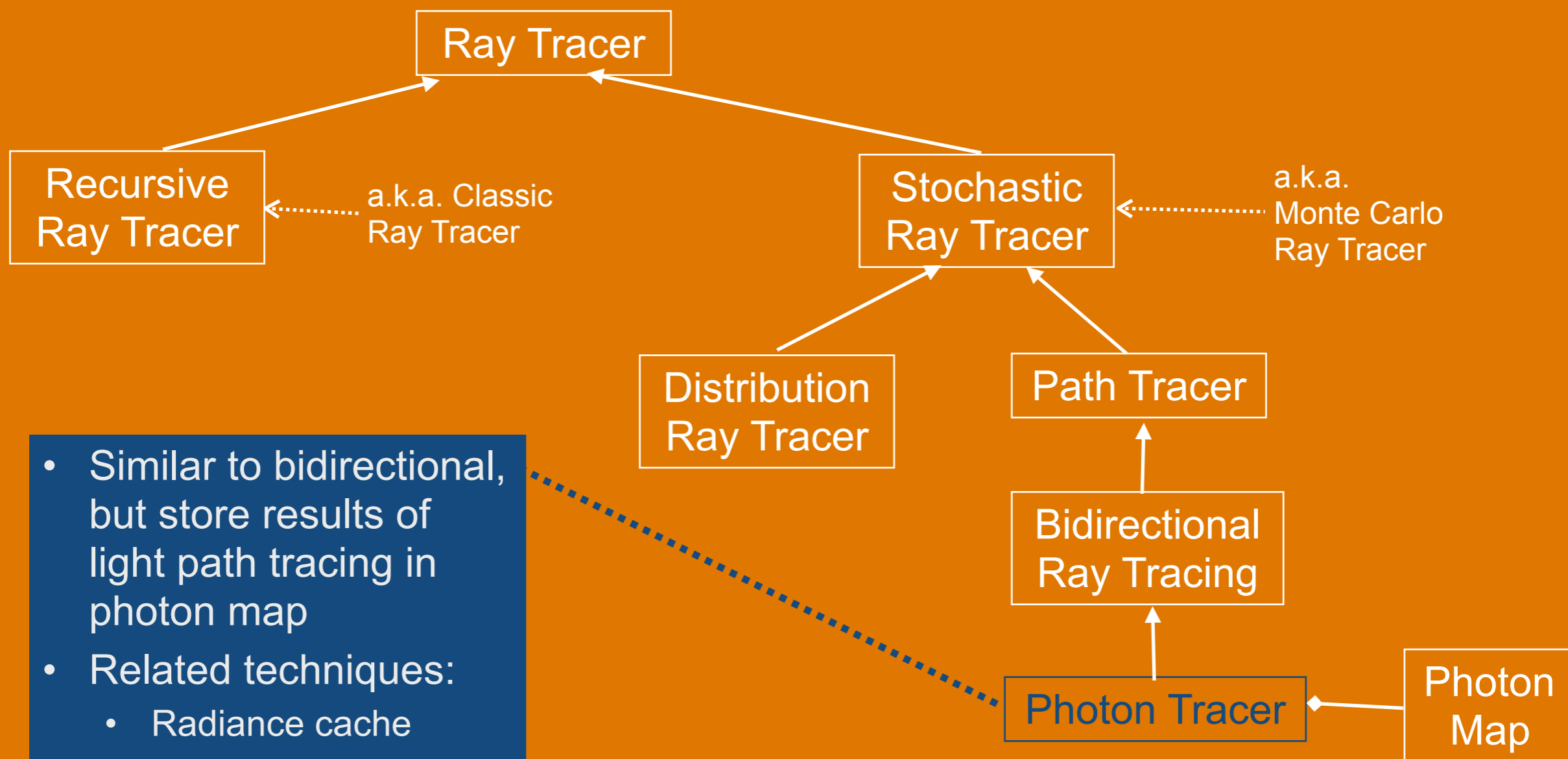
Ray Tracing Type Hierarchy



- Path trace from eye to scene
- Path trace from light sources to scene
- Intersect



Ray Tracing Type Hierarchy



- Similar to bidirectional, but store results of light path tracing in photon map
- Related techniques:
 - Radiance cache
 - Irradiance gradients



The Crux(es) of Stochastic Ray Tracing

- When picking a stochastic ray, what is the distribution of the rays that works best? It is *not* the uniform distribution across the hemisphere!
 - “Importance sampling”
- When a sample is computed, how much does it weigh in the pixel’s total?
- How can one reuse results from earlier rays?



Obligatory “purdy picture”



© 2006
Disney/Pixar.

“With PRMan’s hybrid rendering algorithm there are no visibility rays, but ray tracing can be used to compute e.g. reflections, shadows, and ambient occlusion. Thanks to the use of ray differentials and multiresolution texture and tessellation caches, very complex scenes can be ray-traced....”