Parallel Tracking and Mapping for Small AR Workspaces

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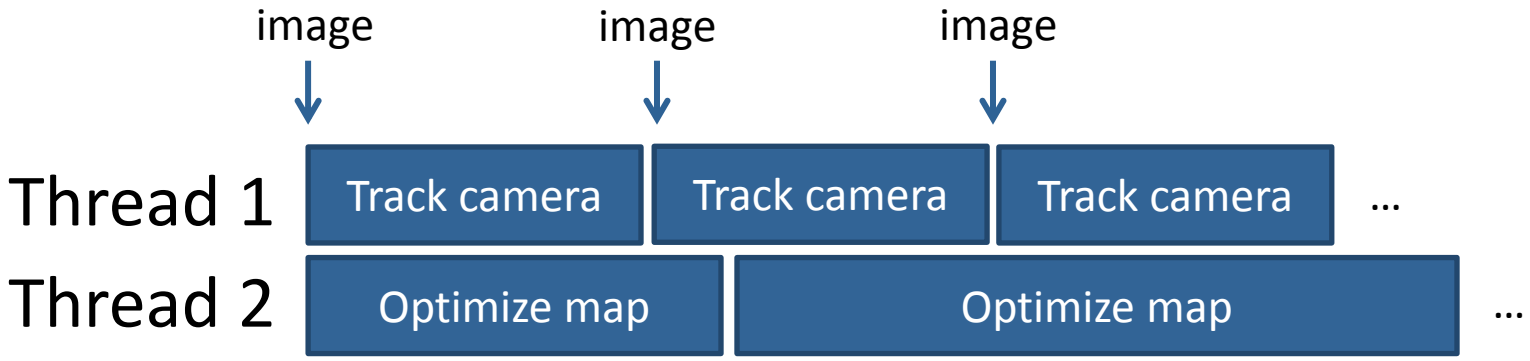
The Aim

- AR with a hand-held camera
- Visual Tracking provides registration
- Track without prior model of world
- Challenges:
  - Speed
  - Accuracy
  - Robustness
  - Interaction with real world

PTAM

- Architecture optimized for dual cores

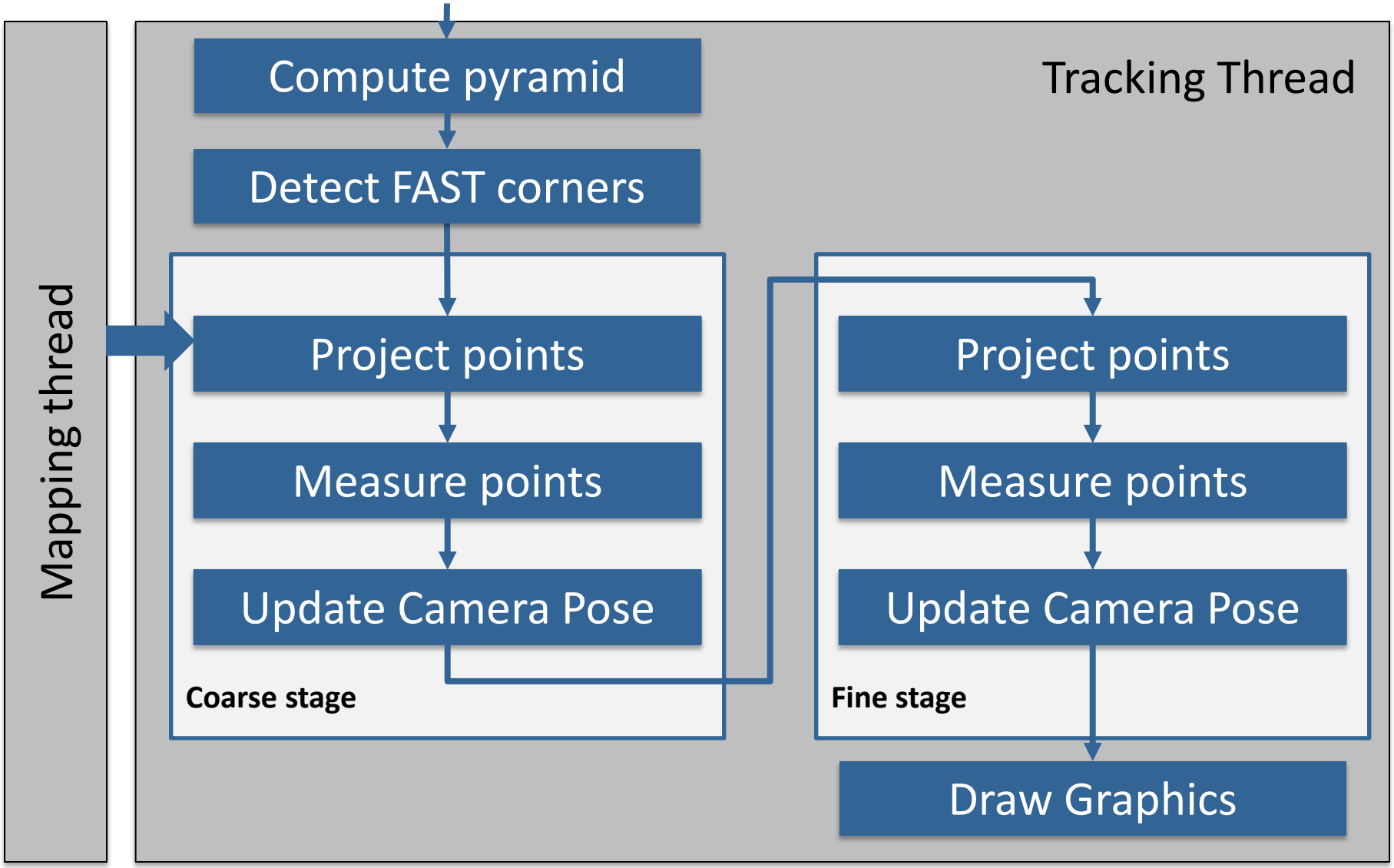


- Tracking thread runs in real-time (30Hz)
- Mapping thread is not real-time

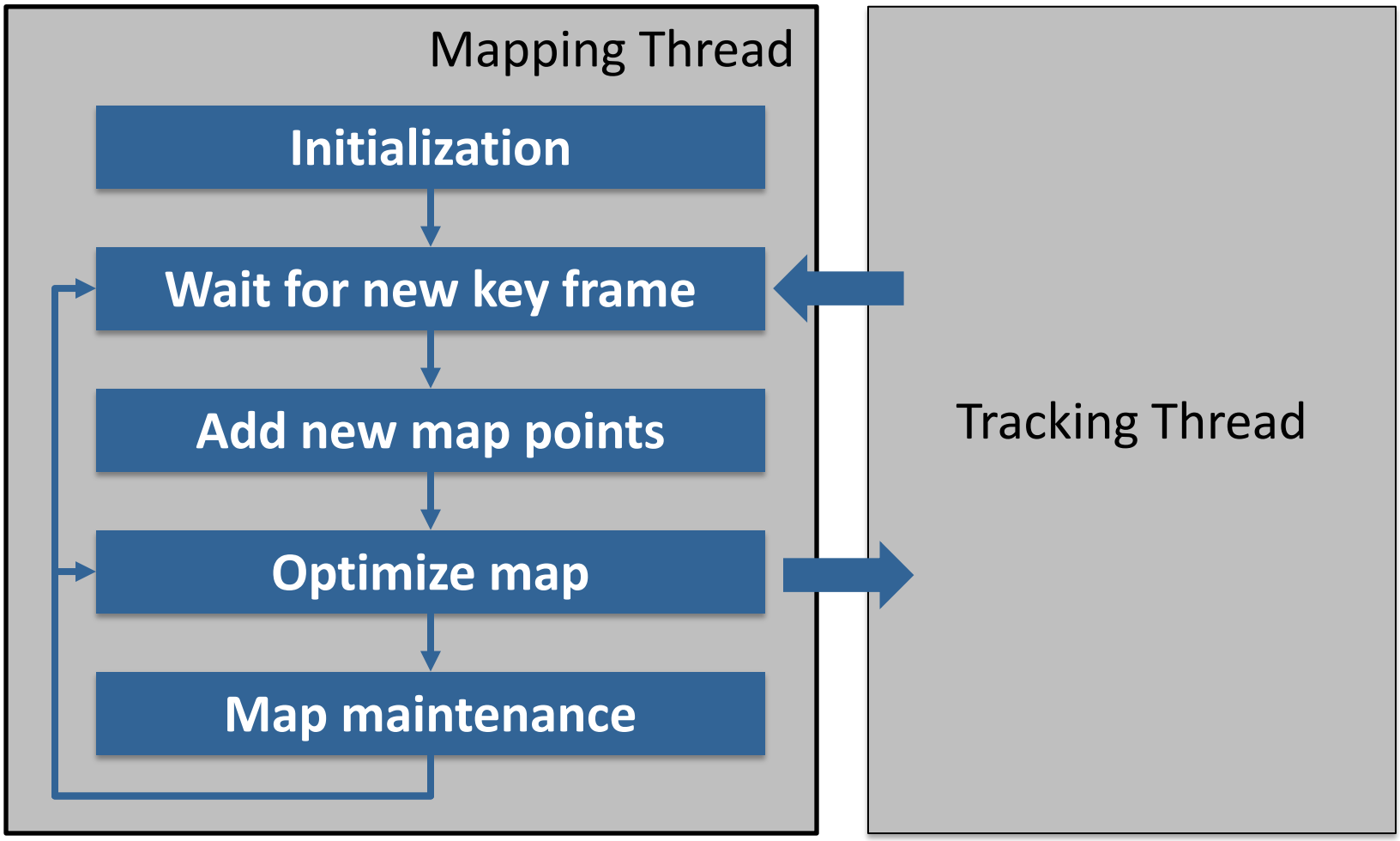
Method Overview

- Tracking thread:
  - Responsible estimation of camera pose and rendering augmented graphics
  - Must run at 30Hz
  - Make as robust and accurate as possible
- Mapping thread:
  - Responsible for providing the map
  - Can take lots of time per keyframe
  - Make as rich and accurate as possible

PTAM – Tracking Thread



PTAM – Mapping Thread



PTAM – Example Timings

- Tracking thread

Total	19.2 ms
Key frame preparation	2.2 ms
Feature Projection	3.5 ms
Patch search	9.8 ms
Iterative pose update	3.7 ms

- Mapping thread

Key frames	2-49	50-99	100-149
Local Bundle Adjustment	170 ms	270 ms	440 ms
Global Bundle Adjustment	380 ms	1.7 s	6.9 s

PTAM Video

https://www.youtube.com/watch?v=Y9HMn6bd-v8