Java Barrier Synchronizers:
Overview

Douglas C. Schmidt
d.schmidt@vanderbilt.edu
www.dre.vanderbilt.edu/~schmidt

Institute for Software
Integrated Systems
Vanderbilt University
Nashville, Tennessee, USA
• Understand how different barrier synchronizers allow threads to wait for operations performed in other threads to complete

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Learning Objectives in this Lesson

• Understand how different barrier synchronizers allow threads to wait for operations performed in other threads to complete

• Recognize a human known use of barrier synchronization
Overview of Barrier Synchronization
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- A barrier is a synchronization mechanism that halts the progress of one or more threads at a particular point.

See [en.wikipedia.org/wiki/Barrier_(computer_science)](en.wikipedia.org/wiki/Barrier_(computer_science))
Overview of Barrier Synchronization

- Barriers can be used several ways
Overview of Barrier Synchronization

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A. **Entry barrier** – e.g., concurrent computations wait until object is initialized
Overview of Barrier Synchronization

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**A. Entry barrier** – e.g., concurrent computations wait until object is initialized

Main thread spawns a number of worker threads & then performs some time-consuming initialization of data structures
Overview of Barrier Synchronization

- Barriers can be used several ways
  
  **A. Entry barrier** – e.g., concurrent computations wait until object is initialized

  The worker threads wait on the barrier until the main thread completes its initializations
Overview of Barrier Synchronization

- Barriers can be used several ways

A. **Entry barrier** – e.g., concurrent computations wait until object is initialized

The main thread signals worker threads that they can begin by decrementing the barrier to 0
Barriers can be used several ways

A. **Entry barrier** – e.g., concurrent computations wait until object is initialized

B. **Exit barrier** – e.g., block until all concurrent threads have done their processing before continuing
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The main thread waits for all worker threads to finish
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**Overview of Barrier Synchronization**

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**The main thread waits for all worker threads to finish**
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A. Entry barrier – e.g., concurrent computations wait until object is initialized

B. Exit barrier – e.g., block until all concurrent threads have done their processing before continuing

The main thread can now continue
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  A. **Entry barrier** – e.g., concurrent computations wait until object is initialized

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  C. **Cyclic barrier** – e.g., a group of threads all wait for each other to reach a barrier before advancing to the next cycle
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A fixed- or variable-size pool of threads can run concurrently
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  **B. Exit barrier** – e.g., block until all concurrent threads have done their processing before continuing

  **C. Cyclic barrier** – e.g., a group of threads all wait for each other to reach a barrier before advancing to the next cycle

At the end of each cycle a decision is made about whether to continue or not
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These categories are not mutually exclusive
Human Known Uses of Barrier Synchronization
Human Known Uses of Barrier Synchronization

- A human known use is protocol used by a museum tour guide

See en.wikipedia.org/wiki/Tour_guide
Human Known Uses of Barrier Synchronization

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**A. Entry barrier** – Group of tourists wait outside museum until it opens
Human Known Uses of Barrier Synchronization

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A. Entry barrier – Group of tourists wait outside museum until it opens

B. Exit barrier – Museum closes after last group of tourists leave
Human Known Uses of Barrier Synchronization

• A human known use is protocol used by a museum tour guide

A. Entry barrier – Group of tourists wait outside museum until it opens

B. Exit barrier – Museum closes after last group of tourists leave

C. Cyclic barrier – Tour guide waits for all tourists to finish exploring a room before continuing tour in next room

Barriers can be used for both fixed- & variable-sized number of tourists
End of Java Barrier Synchronizers: Overview