# Scheduling 2

## Round Robin

******** Nguyen

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# (Nicht-)Unterbrechende Scheduler

# Konzept

# Konzept

**Unterschied**

Nicht-unterbrechende Scheduler lassen alle Prozesse vollständig durchlaufen, bevor es die nächsten an die Reihe nimmt.

# Round Robin

# Funktionsweise

**Quantum**

Unterteilung der Arbeitszeit in Zeitslots

**Warteschlange**

Wenn ein Prozess innerhalb eines Quantums nicht fertig ist, wird es wieder hinten an die Warteschlange gesetzt.

# Round Robin Beispiel

# Beispiel mit 4 Prozessen

| Prozess | Ankunftszeit | Prozessdauer |
|---|---|---|
| P0 | 0ms | 150ms |
| P1 | 30ms | 250ms |
| P2 | 120ms | 50ms |
| P3 | 130ms | 170ms |

| | Zeitstrahl | | | | | Verbleibende Zeit | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Zeit** | **Slot 1** | **Slot 2** | **Slot 3** | **Slot 4** | **Event** | **P0** | **P1** | **P2** | **P3** |
| 0ms | P0 | | | | P0 join | 150 | | | |

# Beispiel mit 4 Prozessen

| Prozess | Ankunftszeit | Prozessdauer |
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| P0 | 0ms | 150ms |
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| | Zeitstrahl | | | | | Verbleibende Zeit | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Zeit** | **Slot 1** | **Slot 2** | **Slot 3** | **Slot 4** | **Event** | **P0** | **P1** | **P2** | **P3** |
| 0ms | P0 | | | | P0 join | 150 | | | |
| 30ms | P0 | P1 | | | P1 join | 120 | 250 | | |

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| Prozess | Ankunftszeit | Prozessdauer |
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| | Zeitstrahl | | | | | Verbleibende Zeit | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Zeit** | **Slot 1** | **Slot 2** | **Slot 3** | **Slot 4** | **Event** | **P0** | **P1** | **P2** | **P3** |
| 0ms | P0 | | | | P0 join | 150 | | | |
| 30ms | P0 | P1 | | | P1 join | 120 | 250 | | |
| 100ms | P1 | P0 | | | Rotate | 50 | 250 | | |

# Beispiel mit 4 Prozessen

| Prozess | Ankunftszeit | Prozessdauer |
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| | Zeitstrahl | | | | | Verbleibende Zeit | | | |
|---|---|---|---|---|---|---|---|---|---|
| Zeit | Slot 1 | Slot 2 | Slot 3 | Slot 4 | Event | P0 | P1 | P2 | P3 |
| 0ms | P0 | | | | P0 join | 150 | | | |
| 30ms | P0 | P1 | | | P1 join | 120 | 250 | | |
| 100ms | P1 | P0 | | | Rotate | 50 | 250 | | |
| 120ms | P1 | P0 | P2 | | P2 join | | 230 | 50 | |

# Beispiel mit 4 Prozessen

| Prozess | Ankunftszeit | Prozessdauer |
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| P0 | 0ms | 150ms |
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| P3 | 130ms | 170ms |

| | Zeitstrahl | | | | | Verbleibende Zeit | | | |
|---|---|---|---|---|---|---|---|---|---|
| Zeit | Slot 1 | Slot 2 | Slot 3 | Slot 4 | Event | P0 | P1 | P2 | P3 |
| 0ms | P0 | | | | P0 join | 150 | | | |
| 30ms | P0 | P1 | | | P1 join | 120 | 250 | | |
| 100ms | P1 | P0 | | | Rotate | 50 | 250 | | |
| 120ms | P1 | P0 | P2 | | P2 join | | 230 | 50 | |
| 130ms | P1 | P0 | P2 | P3 | P3 join | | 220 | | 170 |

# Beispiel mit 4 Prozessen

| Prozess | Ankunftszeit | Prozessdauer |
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| P0 | 0ms | 150ms |
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| P2 | 120ms | 50ms |
| P3 | 130ms | 170ms |

| | Zeitstrahl | | | | | Verbleibende Zeit | | | |
|---|---|---|---|---|---|---|---|---|---|
| Zeit | Slot 1 | Slot 2 | Slot 3 | Slot 4 | Event | P0 | P1 | P2 | P3 |
| 0ms | P0 | | | | P0 join | 150 | | | |
| 30ms | P0 | P1 | | | P1 join | 120 | 250 | | |
| 100ms | P1 | P0 | | | Rotate | 50 | 250 | | |
| 120ms | P1 | P0 | P2 | | P2 join | | 230 | 50 | |
| 130ms | P1 | P0 | P2 | P3 | P3 join | | 220 | | 170 |
| 200ms | P0 | P2 | P3 | P1 | Rotate | 50 | 150 | | |

# Beispiel mit 4 Prozessen

| Prozess | Ankunftszeit | Prozessdauer |
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| P0 | 0ms | 150ms |
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| | Zeitstrahl | | | | | Verbleibende Zeit | | | |
|---|---|---|---|---|---|---|---|---|---|
| Zeit | Slot 1 | Slot 2 | Slot 3 | Slot 4 | Event | P0 | P1 | P2 | P3 |
| 0ms | P0 | | | | P0 join | 150 | | | |
| 30ms | P0 | P1 | | | P1 join | 120 | 250 | | |
| 100ms | P1 | P0 | | | Rotate | 50 | 250 | | |
| 120ms | P1 | P0 | P2 | | P2 join | | 230 | 50 | |
| 130ms | P1 | P0 | P2 | P3 | P3 join | | 220 | | 170 |
| 200ms | P0 | P2 | P3 | P1 | Rotate | 50 | 150 | | |
| 250ms | P2 | P3 | P1 | | P0 finish | 0 | | 50 | |

# Beispiel mit 4 Prozessen

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| | Zeitstrahl | | | | | Verbleibende Zeit | | | |
|---|---|---|---|---|---|---|---|---|---|
| Zeit | Slot 1 | Slot 2 | Slot 3 | Slot 4 | Event | P0 | P1 | P2 | P3 |
| 0ms | P0 | | | | P0 join | 150 | | | |
| 30ms | P0 | P1 | | | P1 join | 120 | 250 | | |
| 100ms | P1 | P0 | | | Rotate | 50 | 250 | | |
| 120ms | P1 | P0 | P2 | | P2 join | | 230 | 50 | |
| 130ms | P1 | P0 | P2 | P3 | P3 join | | 220 | | 170 |
| 200ms | P0 | P2 | P3 | P1 | Rotate | 50 | 150 | | |
| 250ms | P2 | P3 | P1 | | P0 finish | 0 | | 50 | |
| 300ms | P3 | P1 | | | P2 finish | | | 0 | 170 |

# Beispiel mit 4 Prozessen

| Prozess | Ankunftszeit | Prozessdauer |
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| P0 | 0ms | 150ms |
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| P3 | 130ms | 170ms |

| | Zeitstrahl | | | | | Verbleibende Zeit | | | |
|---|---|---|---|---|---|---|---|---|---|
| Zeit | Slot 1 | Slot 2 | Slot 3 | Slot 4 | Event | P0 | P1 | P2 | P3 |
| 0ms | P0 | | | | P0 join | 150 | | | |
| 30ms | P0 | P1 | | | P1 join | 120 | 250 | | |
| 100ms | P1 | P0 | | | Rotate | 50 | 250 | | |
| 120ms | P1 | P0 | P2 | | P2 join | | 230 | 50 | |
| 130ms | P1 | P0 | P2 | P3 | P3 join | | 220 | | 170 |
| 200ms | P0 | P2 | P3 | P1 | Rotate | 50 | 150 | | |
| 250ms | P2 | P3 | P1 | | P0 finish | 0 | | 50 | |
| 300ms | P3 | P1 | | | P2 finish | | | 0 | 170 |
| 400ms | P1 | P3 | | | Rotate | | 150 | | 70 |

# Beispiel mit 4 Prozessen

| Prozess | Ankunftszeit | Prozessdauer |
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| P0 | 0ms | 150ms |
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| P2 | 120ms | 50ms |
| P3 | 130ms | 170ms |

| | Zeitstrahl | | | | | Verbleibende Zeit | | | |
|---|---|---|---|---|---|---|---|---|---|
| Zeit | Slot 1 | Slot 2 | Slot 3 | Slot 4 | Event | P0 | P1 | P2 | P3 |
| 0ms | P0 | | | | P0 join | 150 | | | |
| 30ms | P0 | P1 | | | P1 join | 120 | 250 | | |
| 100ms | P1 | P0 | | | Rotate | 50 | 250 | | |
| 120ms | P1 | P0 | P2 | | P2 join | | 230 | 50 | |
| 130ms | P1 | P0 | P2 | P3 | P3 join | | 220 | | 170 |
| 200ms | P0 | P2 | P3 | P1 | Rotate | 50 | 150 | | |
| 250ms | P2 | P3 | P1 | | P0 finish | 0 | | 50 | |
| 300ms | P3 | P1 | | | P2 finish | | | 0 | 170 |
| 400ms | P1 | P3 | | | Rotate | | 150 | | 70 |
| 500ms | P3 | P1 | | | Rotate | | 50 | | 70 |

# Beispiel mit 4 Prozessen

| Prozess | Ankunftszeit | Prozessdauer |
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| P0 | 0ms | 150ms |
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| Zeitstrahl | | | | | | Verbleibende Zeit | | | |
|---|---|---|---|---|---|---|---|---|---|
| Zeit | Slot 1 | Slot 2 | Slot 3 | Slot 4 | Event | P0 | P1 | P2 | P3 |
| 0ms | P0 | | | | P0 join | 150 | | | |
| 30ms | P0 | P1 | | | P1 join | 120 | 250 | | |
| 100ms | P1 | P0 | | | Rotate | 50 | 250 | | |
| 120ms | P1 | P0 | P2 | | P2 join | | 230 | 50 | |
| 130ms | P1 | P0 | P2 | P3 | P3 join | | 220 | | 170 |
| 200ms | P0 | P2 | P3 | P1 | Rotate | 50 | 150 | | |
| 250ms | P2 | P3 | P1 | | P0 finish | 0 | | 50 | |
| 300ms | P3 | P1 | | | P2 finish | | | 0 | 170 |
| 400ms | P1 | P3 | | | Rotate | | 150 | | 70 |
| 500ms | P3 | P1 | | | Rotate | | 50 | | 70 |
| 570ms | P1 | | | | P3 finish | | 50 | | 0 |

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| | Zeitstrahl | | | | | Verbleibende Zeit | | | |
|---|---|---|---|---|---|---|---|---|---|
| Zeit | Slot 1 | Slot 2 | Slot 3 | Slot 4 | Event | P0 | P1 | P2 | P3 |
| 0ms | P0 | | | | P0 join | 150 | | | |
| 30ms | P0 | P1 | | | P1 join | 120 | 250 | | |
| 100ms | P1 | P0 | | | Rotate | 50 | 250 | | |
| 120ms | P1 | P0 | P2 | | P2 join | | 230 | 50 | |
| 130ms | P1 | P0 | P2 | P3 | P3 join | | 220 | | 170 |
| 200ms | P0 | P2 | P3 | P1 | Rotate | 50 | 150 | | |
| 250ms | P2 | P3 | P1 | | P0 finish | 0 | | 50 | |
| 300ms | P3 | P1 | | | P2 finish | | | 0 | 170 |
| 400ms | P1 | P3 | | | Rotate | | 150 | | 70 |
| 500ms | P3 | P1 | | | Rotate | | 50 | | 70 |
| 570ms | P1 | | | | P3 finish | | 50 | | 0 |
| 620ms | | | | | P1 finish | | 0 | | |

# Fazit

# Fazit

- Alle Prozesse werden hier mit der gleichen Dringlichkeit bearbeitet
- Es wird sicher gegangen, dass kein Prozess verhungert
- Niedrige durchschnittliche Verweilzeit für alle Prozesse
- Worst-case lässt sich leicht berechnen
- Algorithmus ist leicht zu implementieren
- Das Quantum muss gut gewählt sein

# Quellen



Wolfram Burgard. *Systeme I: Betriebssysteme, Kapitel 7 Scheduling*. (letzter Zugriff: 2020-11-01). 2016. URL: http://ais.informatik.uni-freiburg.de/teaching/ws16/systems1/slides/kap07-scheduling.pdf.


Prof. Dir. Margarita Esponda. *Scheduling*. (letzter Zugriff: 2020-11-01). 2012. URL: http://www.inf.fu-berlin.de/lehre/WS11/OS/slides/OS_V7_Scheduling_Teil_1.pdf.


R. Bär und G. Bischofberger und E. Dehler und N. Hammer und B. Schiemann und T. Wolf. *Informatik und Informationstechnik*. EUROPA-LEHRMITTEL, 2017. URL: http://www.inf.fu-berlin.de/lehre/WS11/OS/slides/OS_V7_Scheduling_Teil_1.pdf.