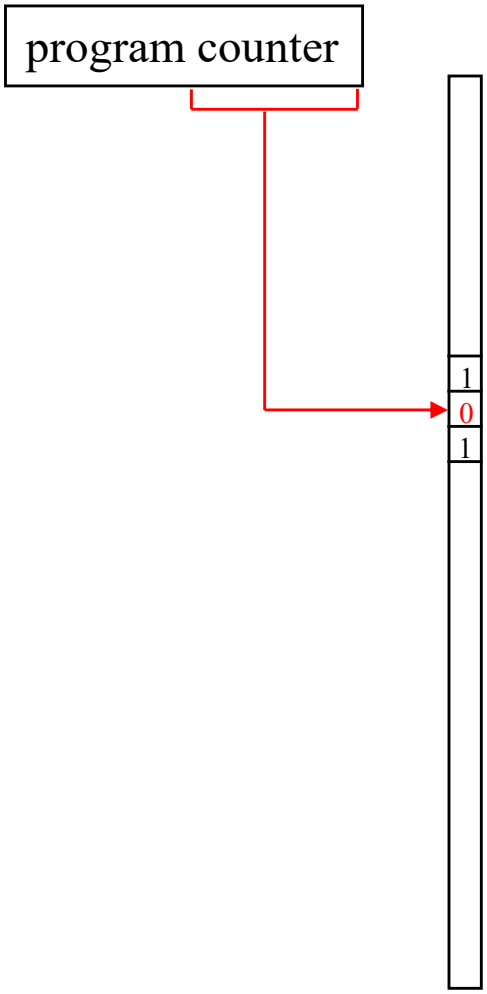
Branch Prediction

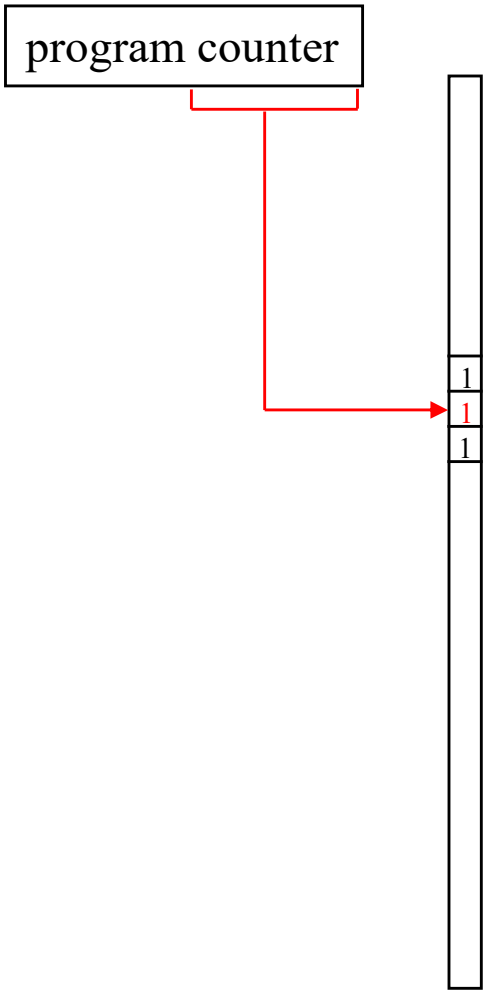


1st iteration
Branch Taken
(predicted not taken)
History -> 1

```
for (i=0;i<10;i++) {
...
...
}
```

```
...
...
add  $i, $i, #1
beq $i, #10, loop
```

Branch Prediction

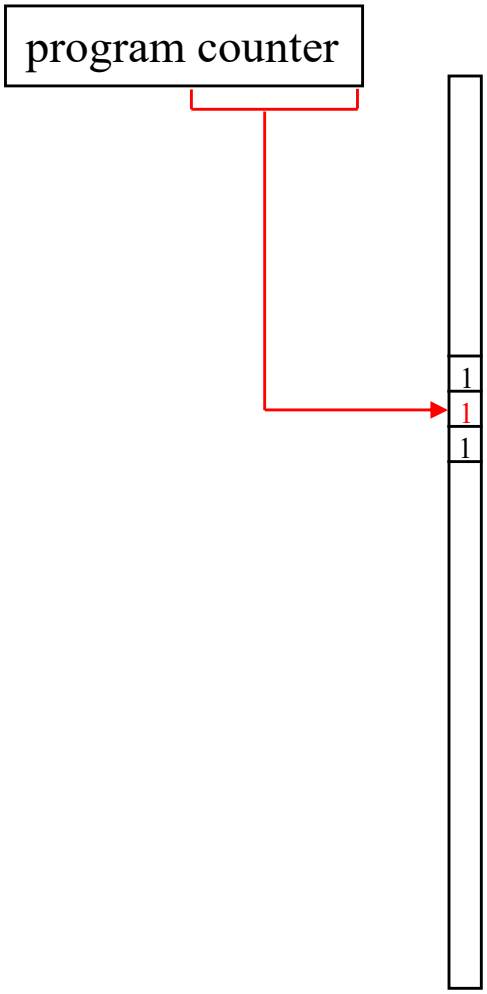


2nd iteration
Branch Taken
(predicted taken)
History -> 1

```
for (i=0;i<10;i++) {
...
...
}
```

```
...
...
add  $i, $i, #1
beq $i, #10, loop
```

Branch Prediction

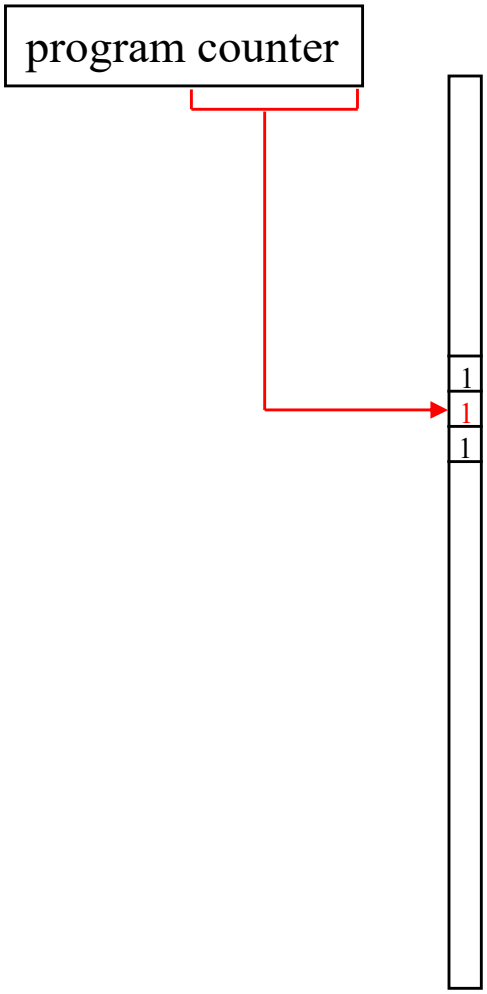


3rd iteration
Branch Taken
(predicted taken)
History -> 1

```
for (i=0;i<10;i++) {
...
...
}
```

```
...
...
add  $i, $i, #1
beq $i, #10, loop
```

Branch Prediction

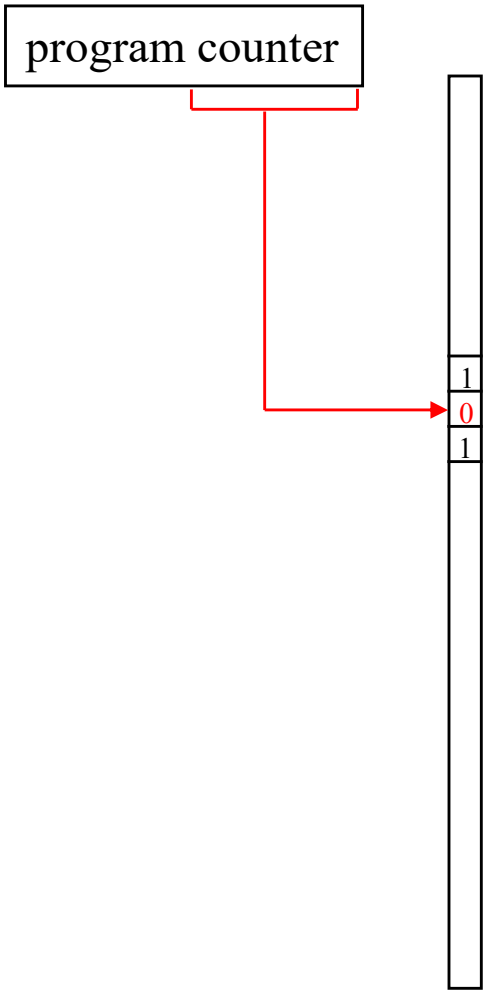


10th iteration
Branch Not Taken
(predicted taken)
History -> 0

```
for (i=0;i<10;i++) {
...
...
}
```

```
...
...
add  $i, $i, #1
beq $i, #10, loop
```

Branch Prediction

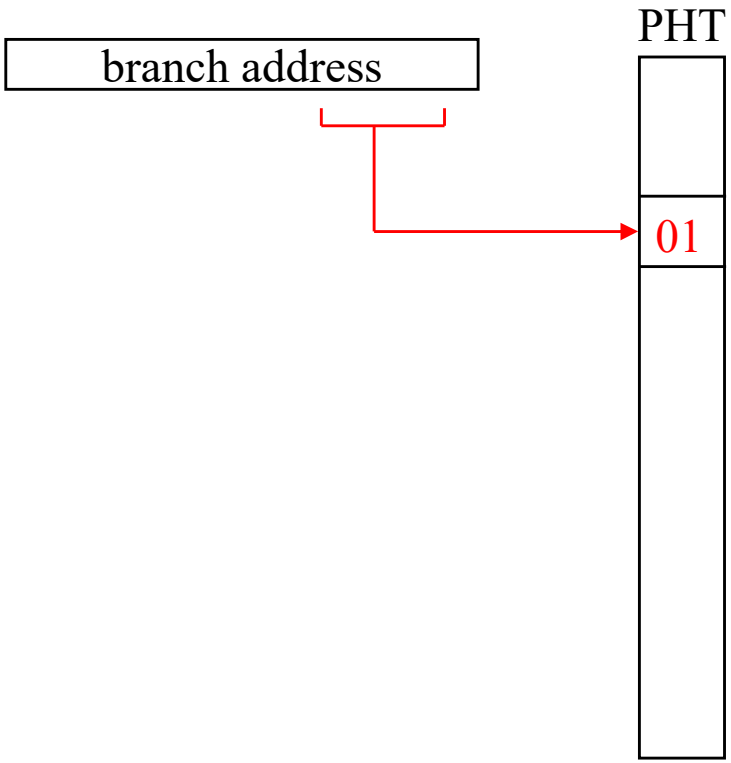


1st iteration again
Branch Taken
(predicted not taken)
History -> 1

```
for (i=0;i<10;i++) {
...
...
}
```

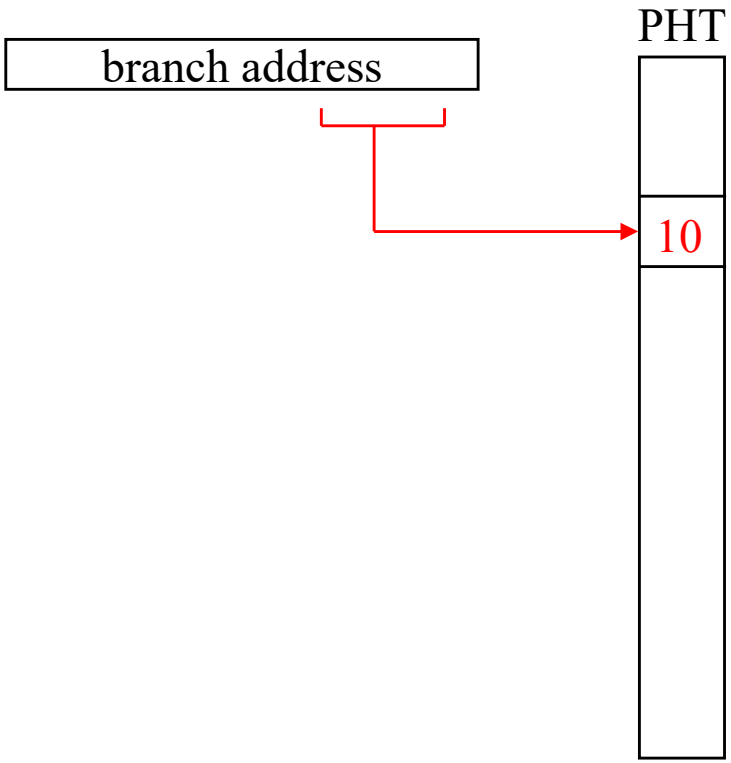
```
...
...
add  $i, $i, #1
beq $i, #10, loop
```

2-bit Branch History Table



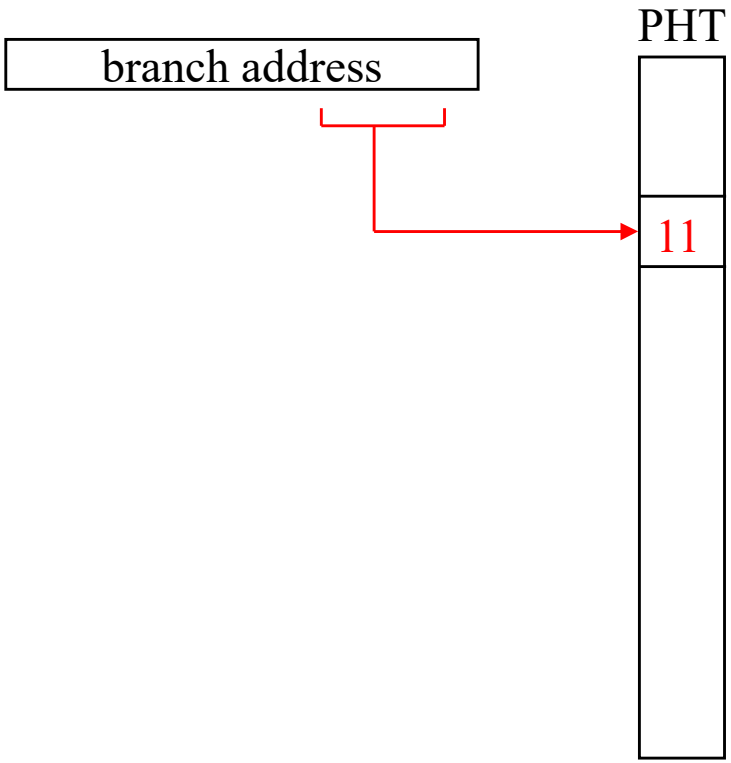
1st iteration
Branch Taken
(predicted not taken)
History -> 10

2-bit Branch History Table



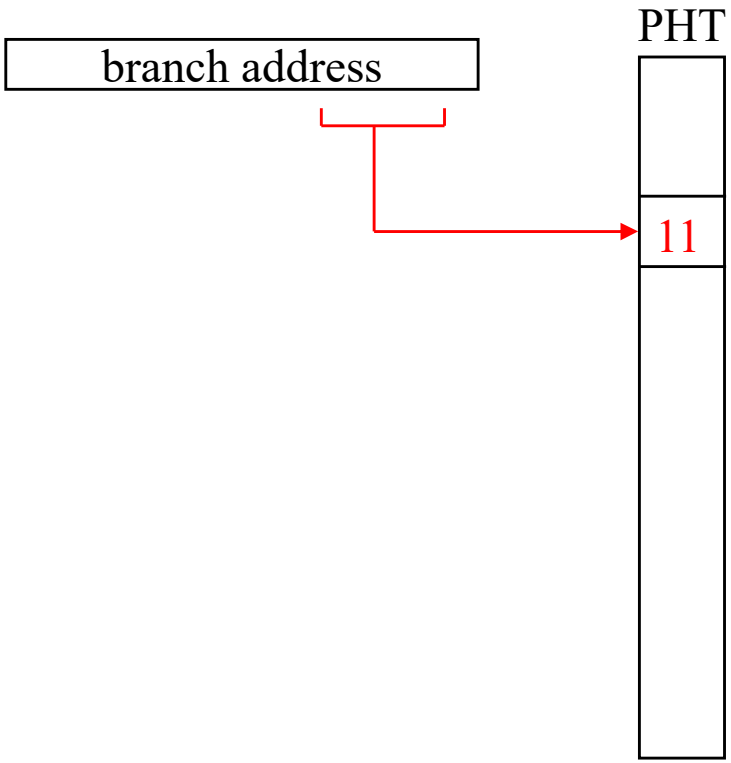
2nd iteration
Branch Taken
(predicted taken)
History -> 11

2-bit Branch History Table



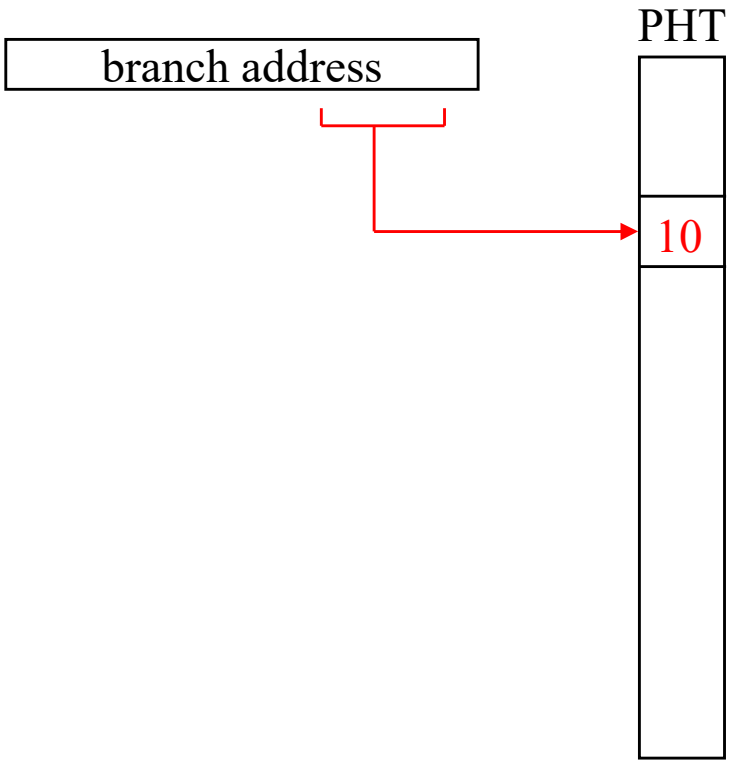
3rd iteration
Branch Taken
(predicted taken)
History -> 11

2-bit Branch History Table



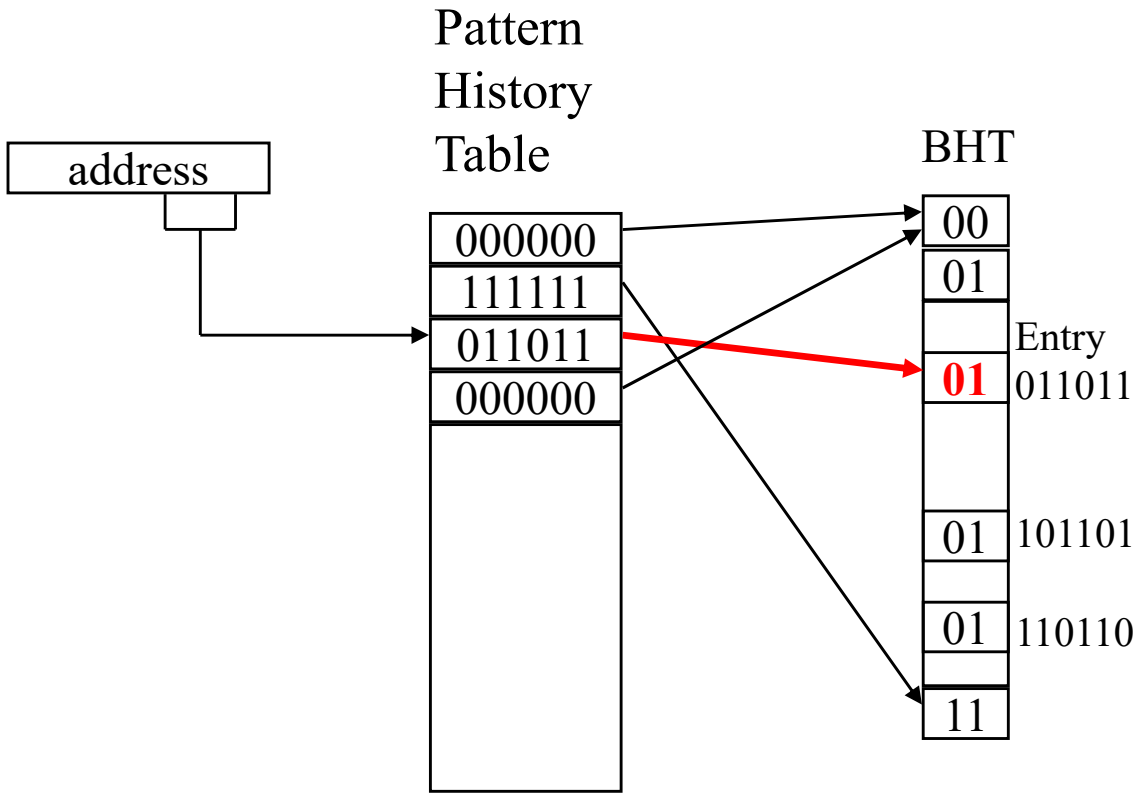
10^{th} iteration
Branch Not Taken
(predicted taken)
History -> 10

2-bit Branch History Table



1st iteration again
Branch Taken
(predicted taken)
History -> 11

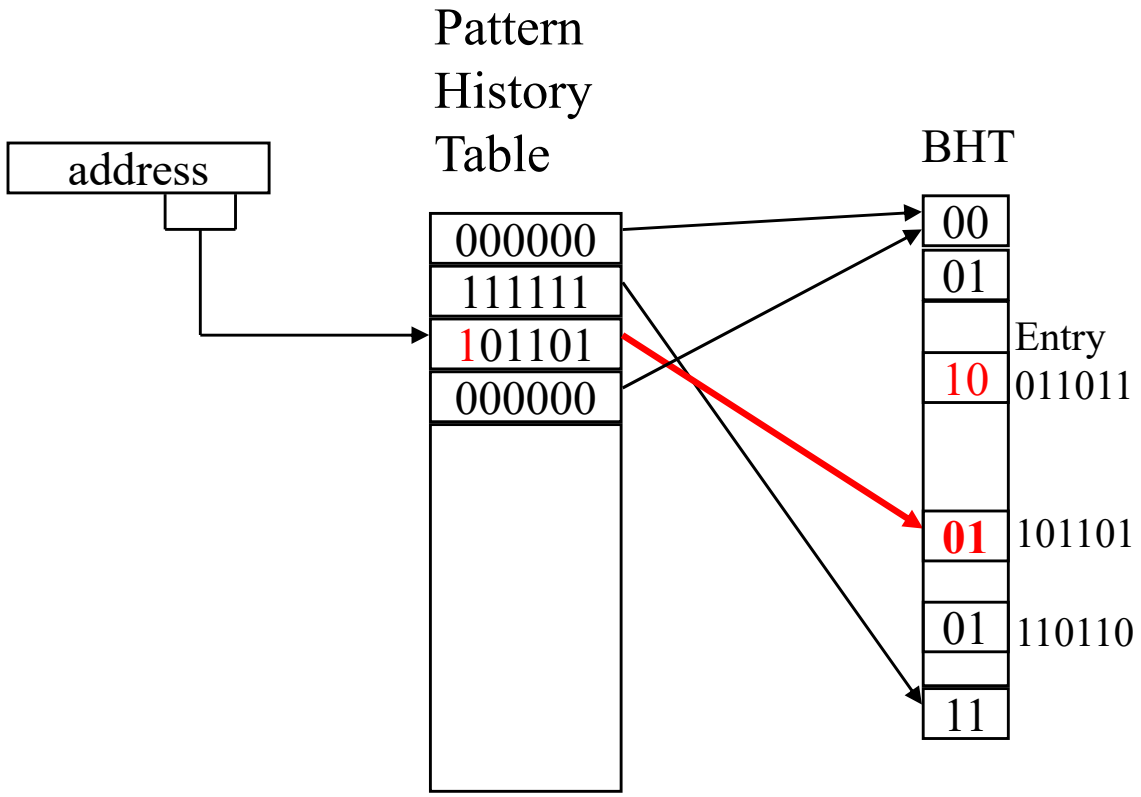
2-level predictor



First iteration
Branch Taken
Predicted not taken
BHT -> 10
Pattern Hist Table -> 101101

Assume a loop that repeatedly executes three iterations (thus, the branch is TTNTTNTTN…

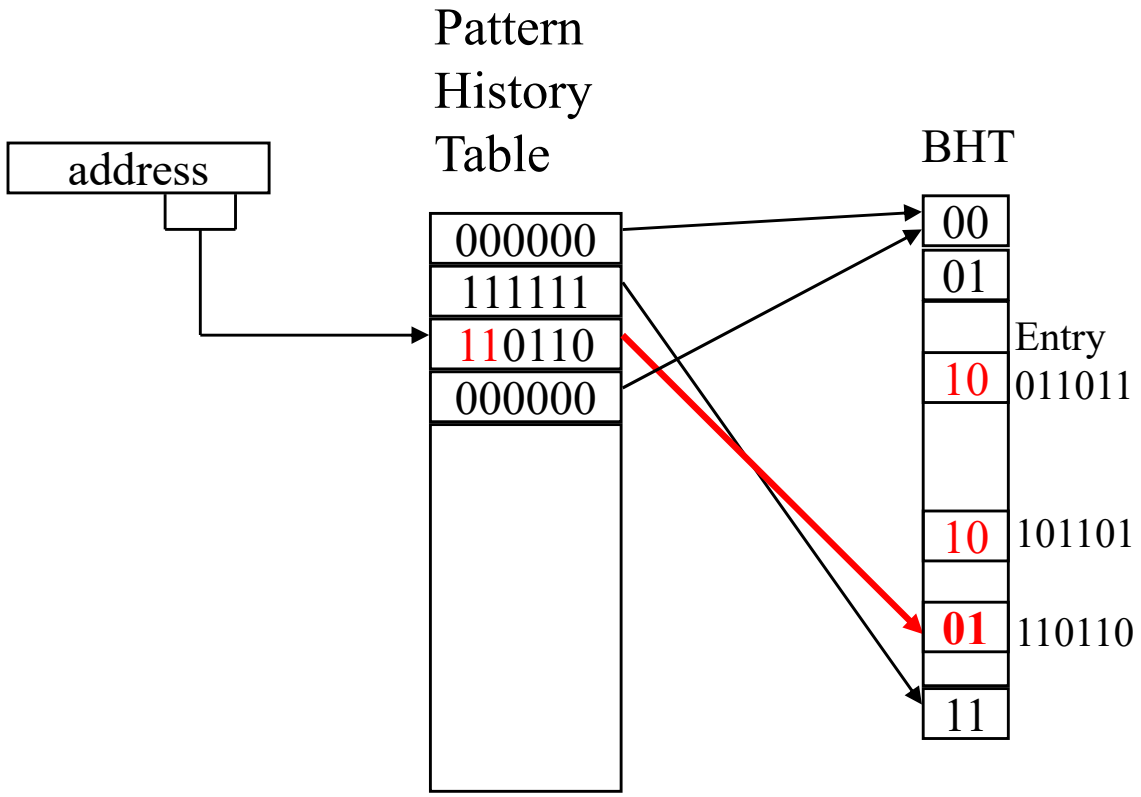
2-level predictor



Second iteration
Branch Taken
Predicted not taken
BHT -> 10
Pattern Hist Table -> 110110

Assume a loop that repeatedly executes three iterations (thus, the branch is TTNTTNTTN…

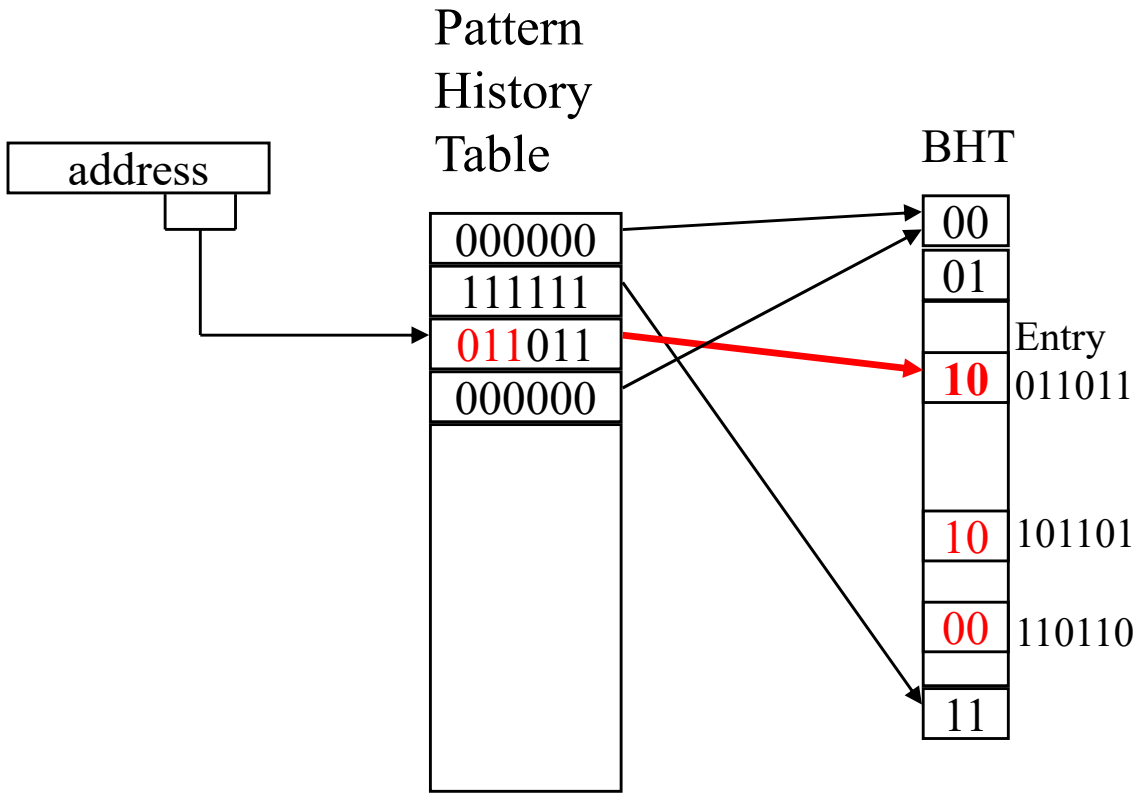
2-level predictor



Third iteration
Branch not taken
Predicted not taken
BHT -> 00
Pattern Hist Table -> 011011

Assume a loop that repeatedly executes three iterations (thus, the branch is TTNTTNTTN…

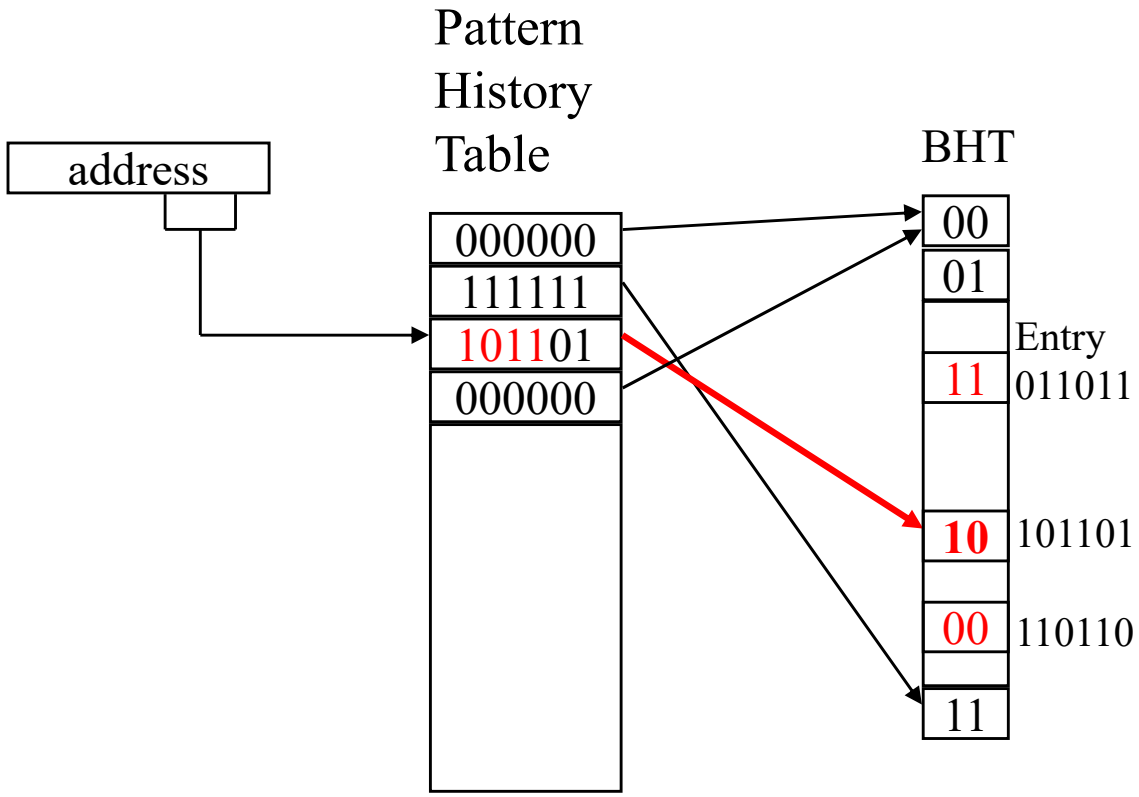
2-level predictor



First iteration, again
Branch taken
Predicted taken
BHT -> 11
Pattern Hist Table -> 101101

Assume a loop that repeatedly executes three iterations (thus, the branch is TTNTTNTTN…

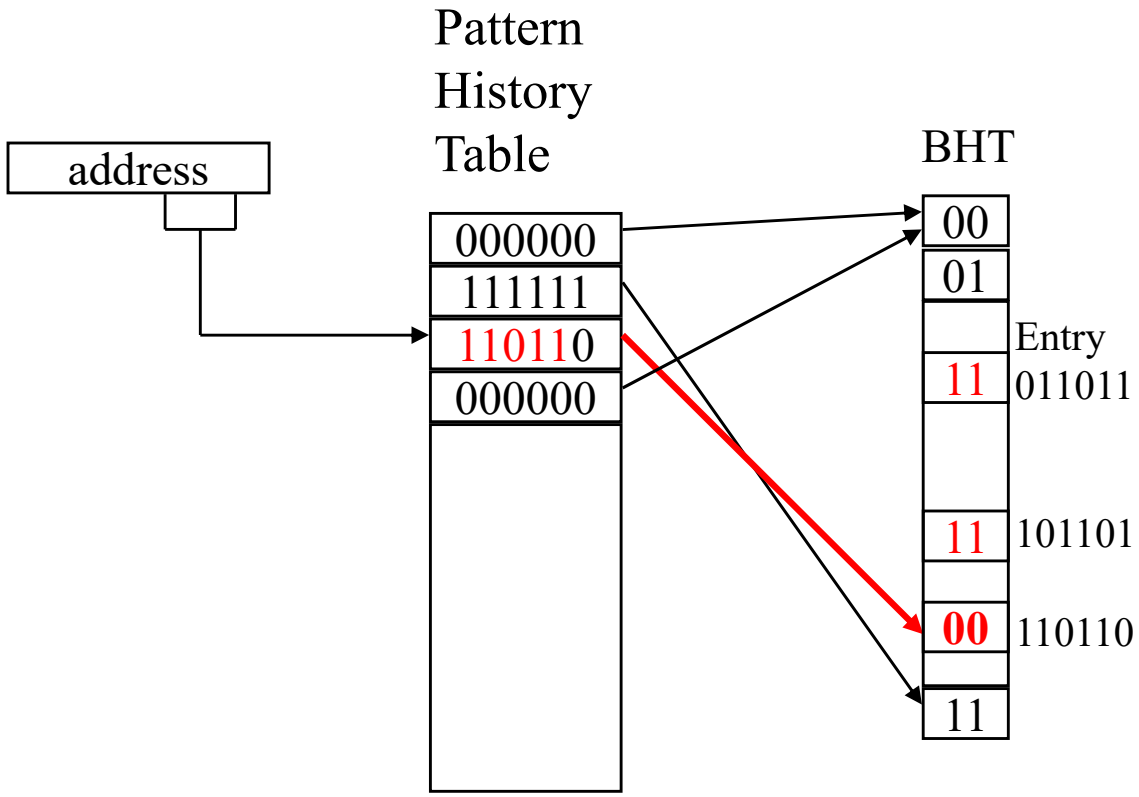
2-level predictor



Second iteration, again
Branch taken
Predicted taken
BHT -> 11
Pattern Hist Table -> 110110

Assume a loop that repeatedly executes three iterations (thus, the branch is TTNTTNTTN…

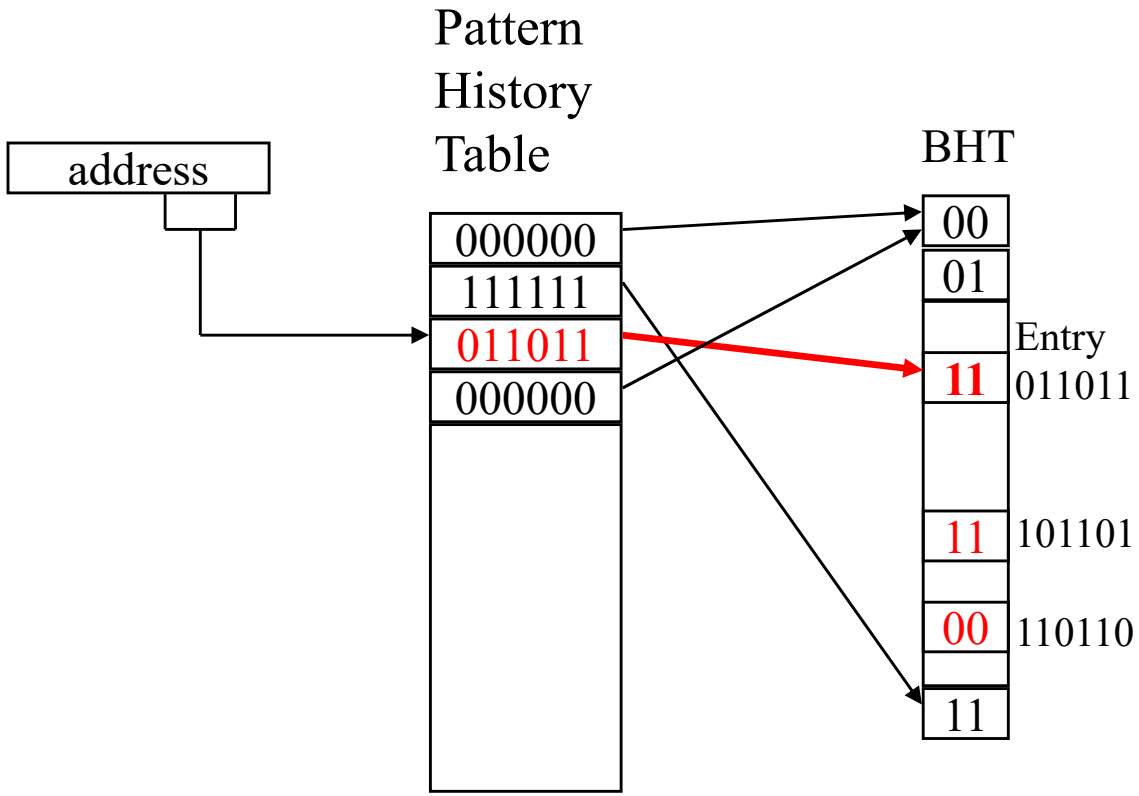
2-level predictor



Third iteration, again
Branch not taken
Predicted not taken
BHT -> 00
Pattern Hist Table -> 011011

Assume a loop that repeatedly executes three iterations (thus, the branch is TTNTTNTTN…

2-level predictor



First iteration, yet again
Branch taken
Predicted taken
BHT -> 11
Pattern Hist Table -> 101101

Assume a loop that repeatedly executes three iterations (thus, the branch is TTNTTNTTN…