Directory Protocol Example
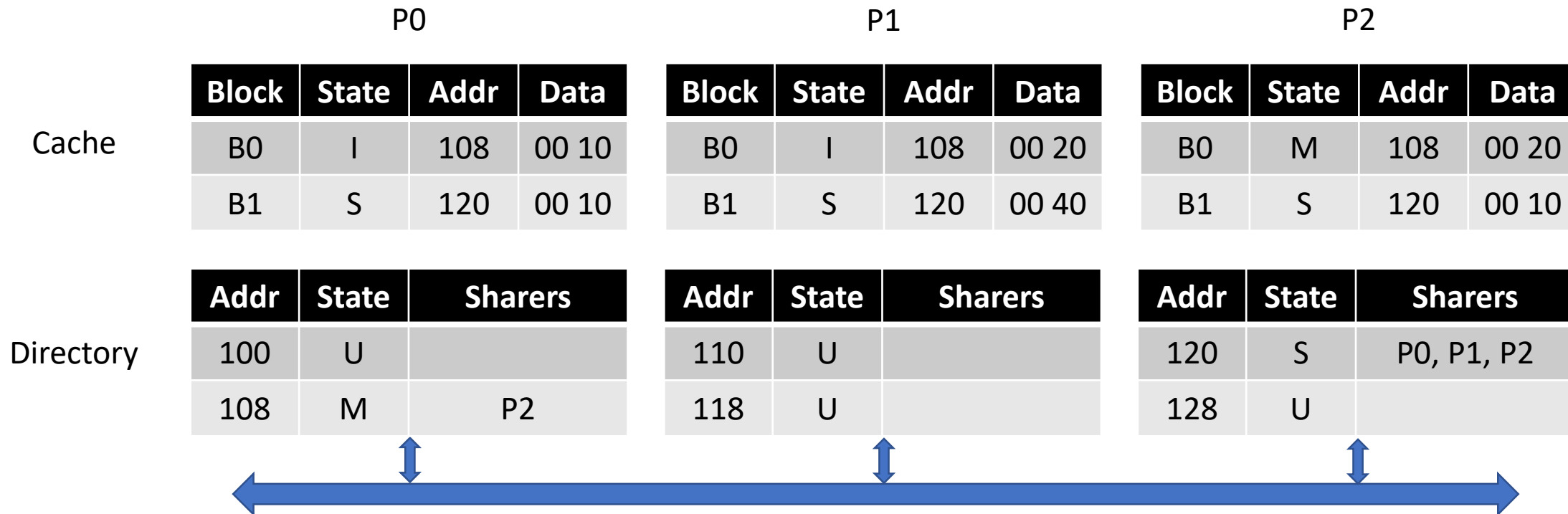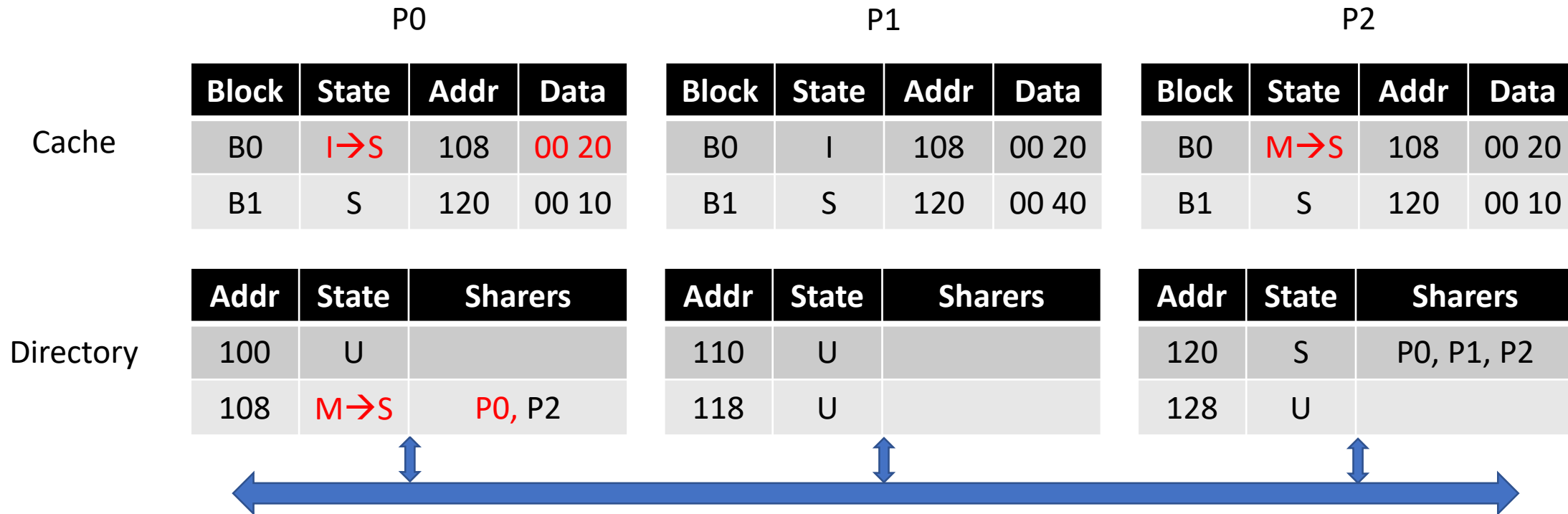
- P0: read 108
- P0: write 108 <-- 80
- P2: write 108 <-- 84
- P1: read 108
- P0: write 120 <-- 48
- P0: write 120 <-- 78
- P2: write 120 <-- 70

P0

Cache

Block	State	Addr	Data
B0	I	108	00 10
B1	S	120	00 10

Directory

Addr	State	Sharers
100	U	
108	M	P2

P1

Block	State	Addr	Data
B0	I	108	00 20
B1	S	120	00 40

Addr	State	Sharers
110	U	
118	U	

P2

Block	State	Addr	Data
B0	M	108	00 20
B1	S	120	00 10

Addr	State	Sharers
120	S	P0, P1, P2
128	U	

Directory Protocol Example

P0

Cache

Block	State	Addr	Data
B0	I→S	108	00 20
B1	S	120	00 10

Directory

Addr	State	Sharers
100	U	
108	M→S	P0, P2

P1

Block	State	Addr	Data
B0	I	108	00 20
B1	S	120	00 40

Addr	State	Sharers
110	U	
118	U	

P2

Block	State	Addr	Data
B0	M→S	108	00 20
B1	S	120	00 10

Addr	State	Sharers
120	S	P0, P1, P2
128	U	

Directory Protocol Example

- P0: read 108
- P0: write 108 <-- 80
- P2: write 108 <-- 84
- P1: read 108
- P0: write 120 <-- 48
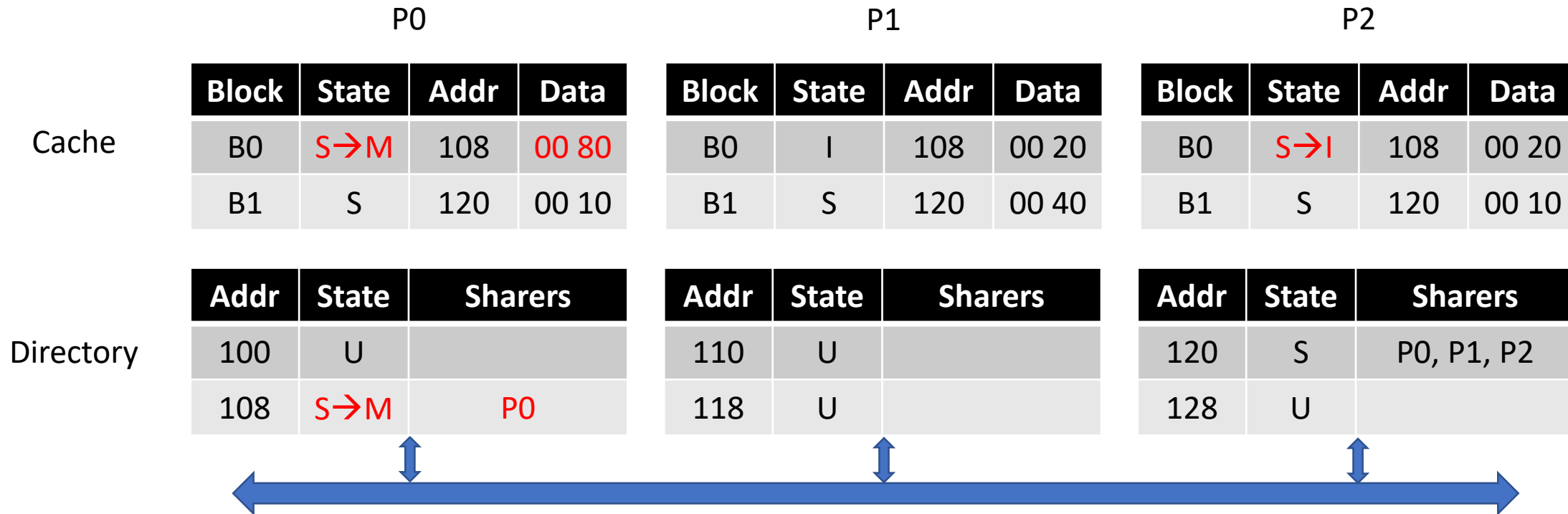- P0: write 120 <-- 78
- P2: write 120 <-- 70

P0

Cache

Block	State	Addr	Data
B0	S→M	108	00 80
B1	S	120	00 10

Directory

Addr	State	Sharers
100	U	
108	S→M	P0

P1

Block	State	Addr	Data
B0	I	108	00 20
B1	S	120	00 40

Addr	State	Sharers
110	U	
118	U	

P2

Block	State	Addr	Data
B0	S→I	108	00 20
B1	S	120	00 10

Addr	State	Sharers
120	S	P0, P1, P2
128	U	

Directory Protocol Example

- P0: read 108
- P0: write 108 <-- 80
- P2: write 108 <-- 84
- P1: read 108
- P0: write 120 <-- 48
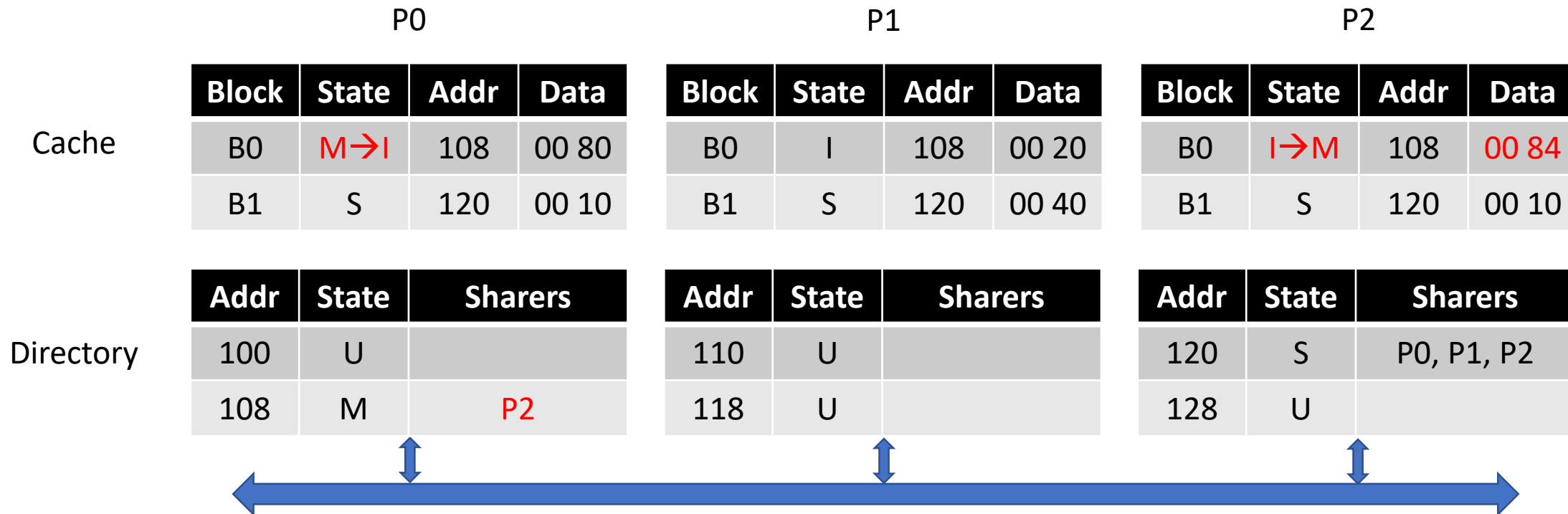- P0: write 120 <-- 78
- P2: write 120 <-- 70

P0

Cache

Block	State	Addr	Data
B0	M→I	108	00 80
B1	S	120	00 10

Directory

Addr	State	Sharers
100	U	
108	M	P2

P1

Block	State	Addr	Data
B0	I	108	00 20
B1	S	120	00 40

Addr	State	Sharers
110	U	
118	U	

P2

Block	State	Addr	Data
B0	I→M	108	00 84
B1	S	120	00 10

Addr	State	Sharers
120	S	P0, P1, P2
128	U	

Directory Protocol Example

- P0: read 108
- P0: write 108 <-- 80
- P2: write 108 <-- 84
- P1: read 108
- P0: write 120 <-- 48
- P0: write 120 <-- 78
- P2: write 120 <-- 70

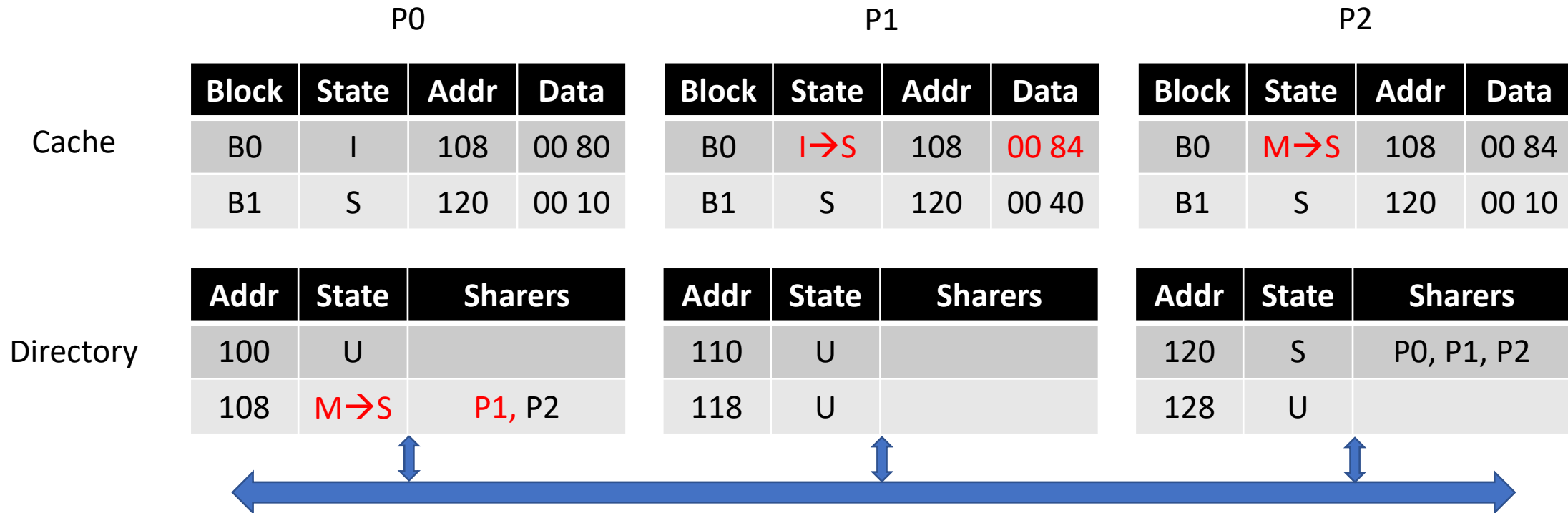## P0

Cache

Block	State	Addr	Data
B0	I	108	00 80
B1	S	120	00 10

Directory

Addr	State	Sharers
100	U	
108	M→S	P1, P2

P1

Block	State	Addr	Data
B0	I→S	108	00 84
B1	S	120	00 40

Addr	State	Sharers
110	U	
118	U	

P2

Block	State	Addr	Data
B0	M→S	108	00 84
B1	S	120	00 10

Addr	State	Sharers
120	S	P0, P1, P2
128	U	

Directory Protocol Example

- P0: read 108
- P0: write 108 <-- 80
- P2: write 108 <-- 84
- P1: read 108
- **P0: write 120 <-- 48**
- P0: write 120 <-- 78
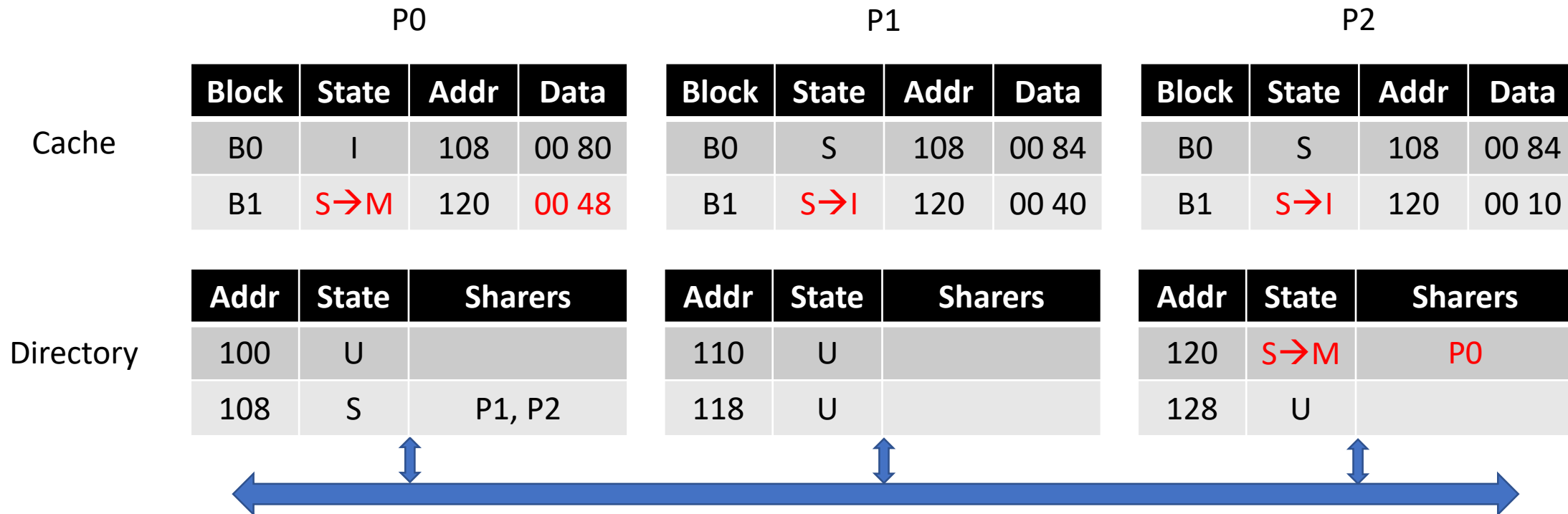- P2: write 120 <-- 70

P0

Cache

Block	State	Addr	Data
B0	I	108	00 80
B1	S→M	120	00 48

Directory

Addr	State	Sharers
100	U	
108	S	P1, P2

P1

Block	State	Addr	Data
B0	S	108	00 84
B1	S→I	120	00 40

Addr	State	Sharers
110	U	
118	U	

P2

Block	State	Addr	Data
B0	S	108	00 84
B1	S→I	120	00 10

Addr	State	Sharers
120	S→M	P0
128	U	

Directory Protocol Example

- P0: read 108
- P0: write 108 <-- 80
- P2: write 108 <-- 84
- P1: read 108
- P0: write 120 <-- 48
- P0: write 120 <-- 78
- P2: write 120 <-- 70

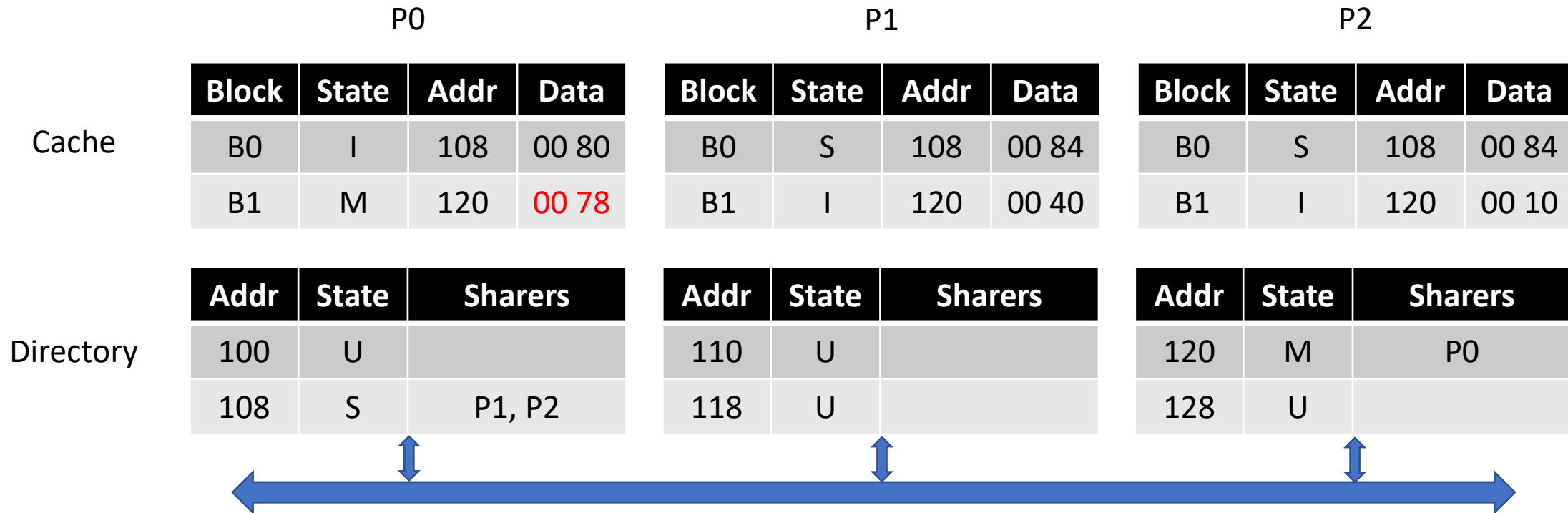### P0

Cache

Block	State	Addr	Data
B0	I	108	00 80
B1	M	120	00 78

Directory

Addr	State	Sharers
100	U	
108	S	P1, P2

P1

Block	State	Addr	Data
B0	S	108	00 84
B1	I	120	00 40

Addr	State	Sharers
110	U	
118	U	

P2

Block	State	Addr	Data
B0	S	108	00 84
B1	I	120	00 10

Addr	State	Sharers
120	M	P0
128	U	

Directory Protocol Example

- P0: read 108
- P0: write 108 <-- 80
- P2: write 108 <-- 84
- P1: read 108
- P0: write 120 <-- 48
- P0: write 120 <-- 78
- P2: write 120 <-- 70

P0

Cache

Block	State	Addr	Data
B0	I	108	00 80
B1	M→I	120	00 78

P1

Block	State	Addr	Data
B0	S	108	00 84
B1	I	120	00 40

P2

Block	State	Addr	Data
B0	S	108	00 84
B1	I→M	120	00 70

Directory

Addr	State	Sharers
100	U	
108	S	P1, P2

Addr	State	Sharers
110	U	
118	U	

Addr	State	Sharers
120	M	P2
128	U	