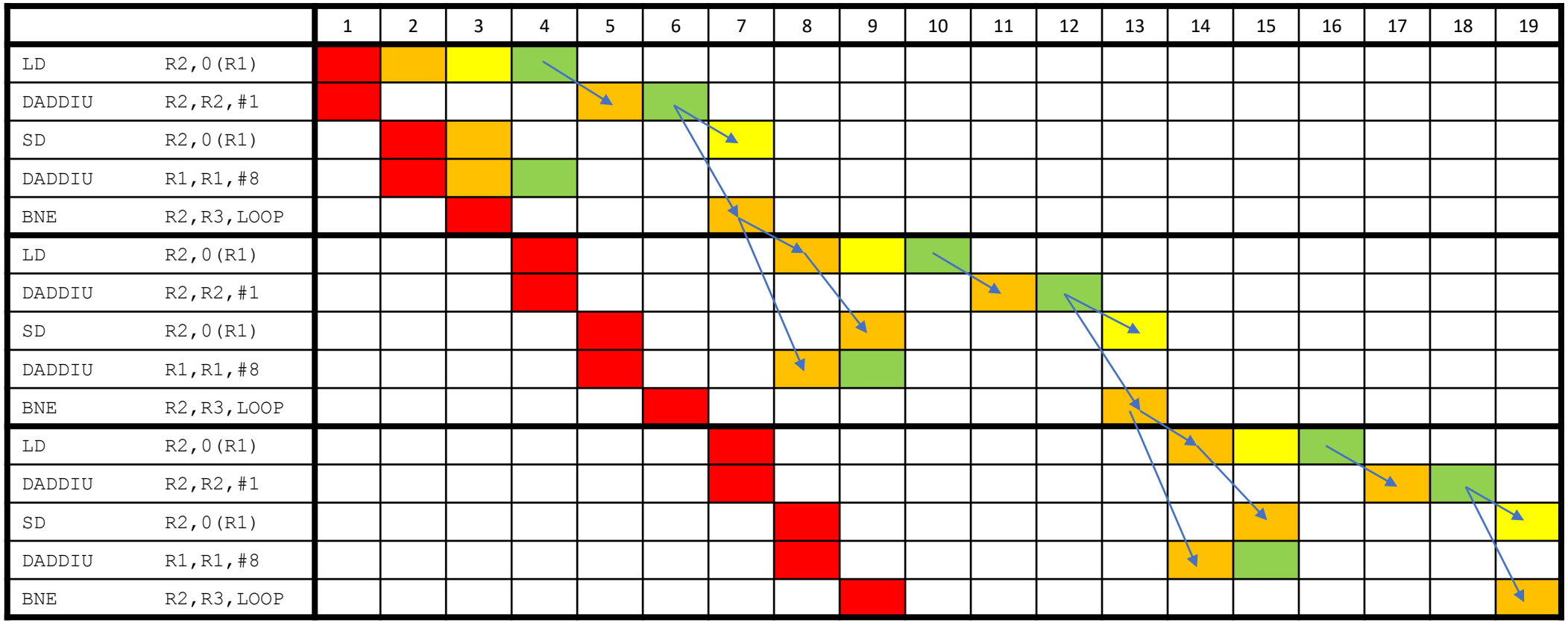
Putting It All Together

- When we combine dynamic scheduling, multiple issue, and speculation, we create a microarchitecture similar to those in modern processors.
- This integration allows for significant performance improvements by executing multiple instructions simultaneously while handling dependencies and branch predictions.

Example

```
Loop:   LD      R2,0(R1)        ;R2=array element
        DADDIU  R2,R2,#1        ;increment R2
        SD      R2,0(R1)        ;store result
        DADDIU  R1,R1,#8        ;increment pointer
        BNE     R2,R3,LOOP      ;branch if not last element
```

One address calculation
One ALU operation
One branch evaluation
Two instruction committed
Per cycle



Example with Speculation

```
Loop:   LD      R2,0(R1)        ;R2=array element
        DADDIU  R2,R2,#1        ;increment R2
        SD      R2,0(R1)        ;store result
        DADDIU  R1,R1,#8        ;increment pointer
        BNE     R2,R3,LOOP      ;branch if not last element
```

One address calculation
One ALU operation
One branch evaluation
Two instruction committed
Per cycle