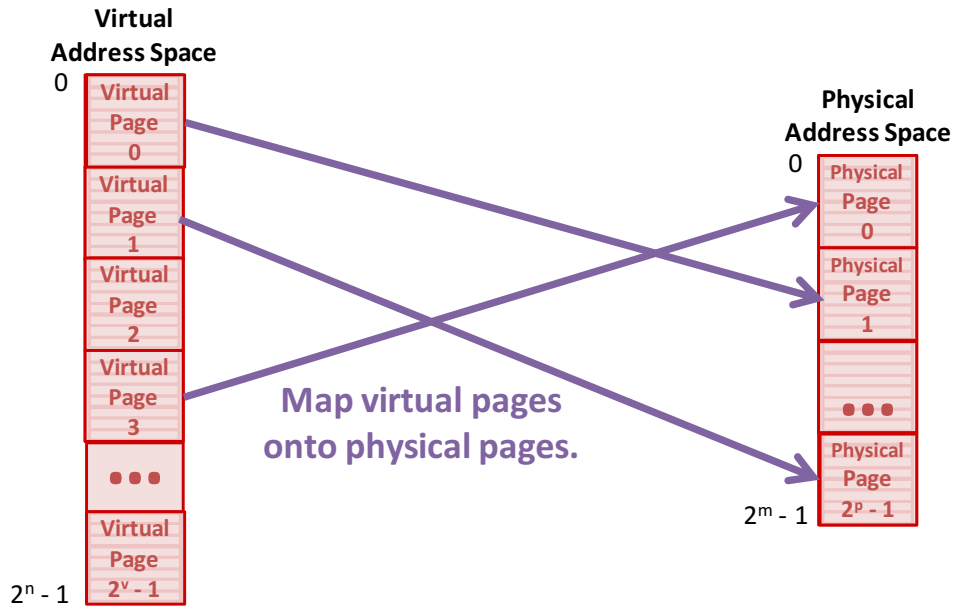
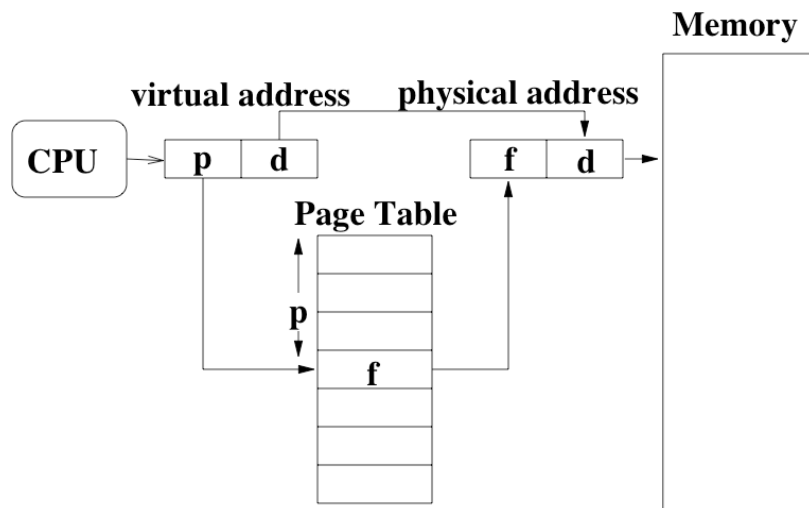


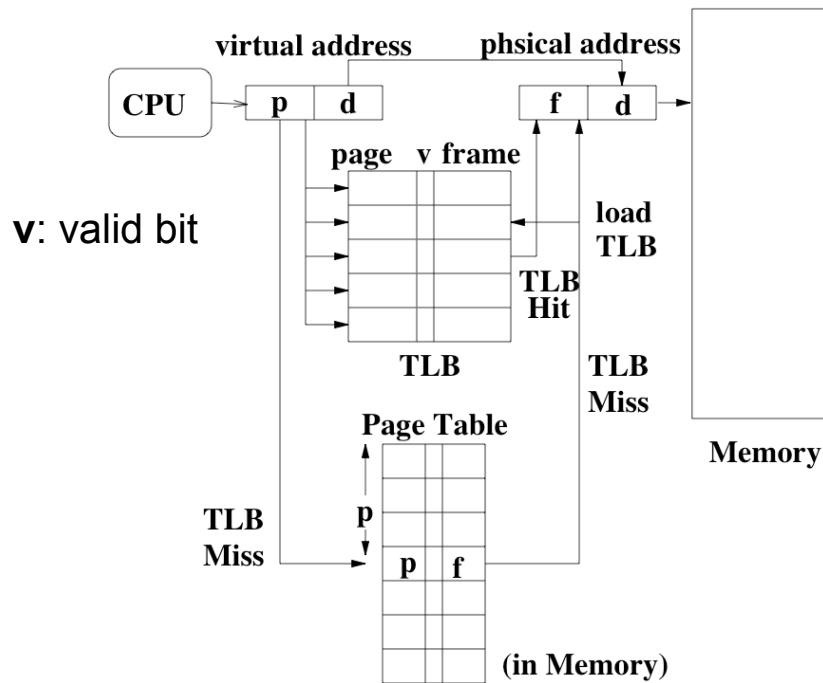
Memory Pages



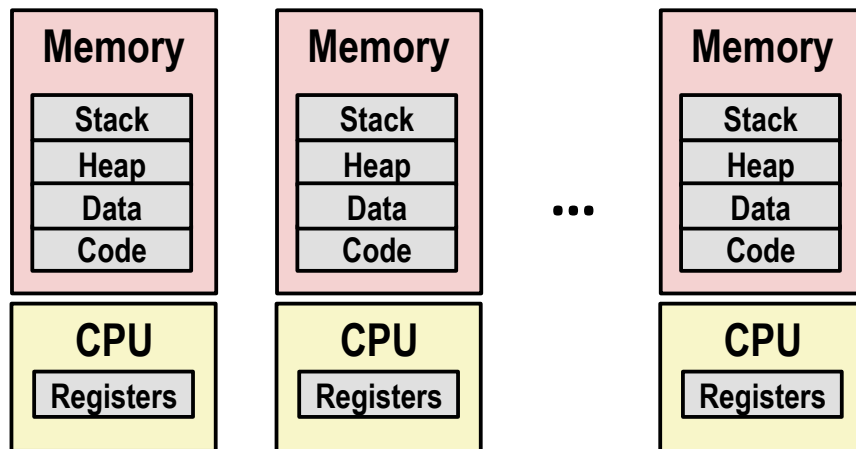
Page Tables



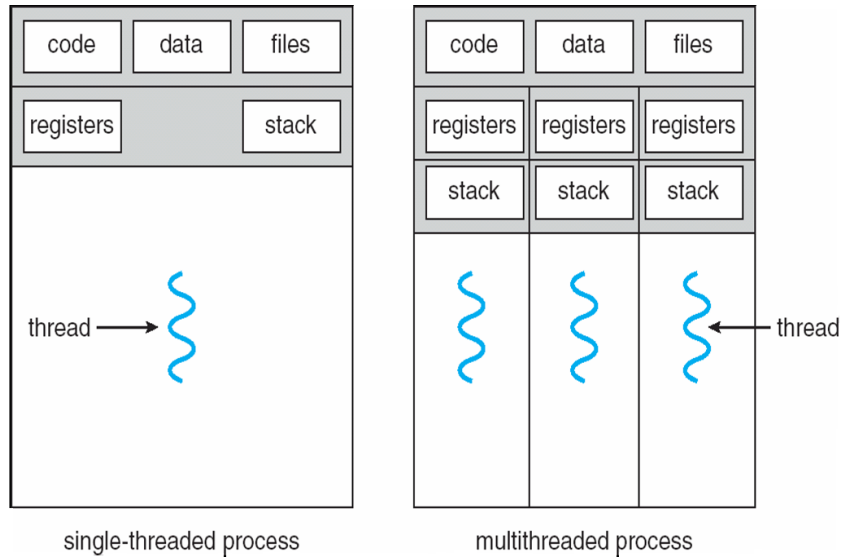
Translation Look-aside Buffer (TLB)



Processes



Threads



Thread Example

```
/*
 * hello.c - Pthreads "hello, world" program
 */
void* thread(void* vargp);

int main() {
    pthread_t tid;
    pthread_create(&tid, NULL, thread, NULL);
    pthread_join(tid, NULL);
    exit(0);
}
hello.c
```

Thread ID (points to `tid`)

Thread attributes (usually NULL) (points to `NULL`)

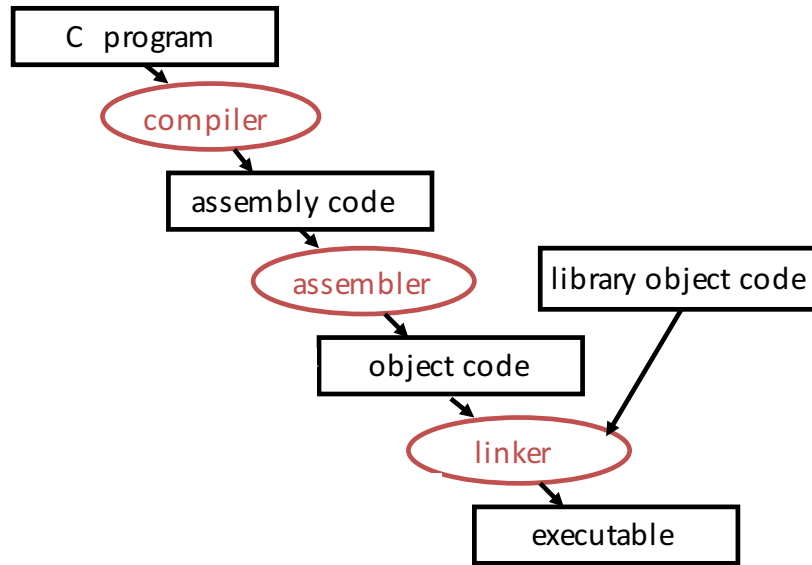
Thread routine (points to `thread`)

Thread arguments (void *p) (points to `NULL`)

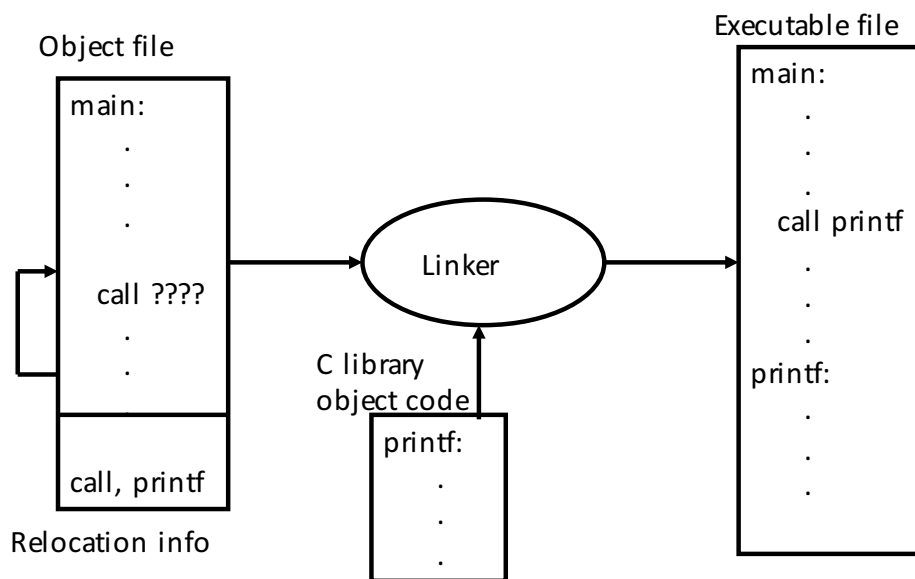
Return value (void **p) (points to `NULL`)

```
void* thread(void* vargp) { /* thread routine */
    printf("Hello, world!\n");
    return NULL;
}
hello.c
```

Linking



Linking Schematic



Course Themes

- Abstraction
- Representation
- Performance
- Security + Reliability

