

commit ??? .git ?? ??

?????

- 1. hello.txt
- 2. git add hello.txt
- 3. git commit -m "Add hello"

1. ?? (Working Directory)

```
echo "Hello Git" > hello.txt
```

-
- Git

2. git add hello.txt

```
git add hello.txt
```

?? ??:

.git/index	
.git/objects/	hello.txt blob (SHA-1)

?? :

```
.git/  
└─ objects/
```

└─ 3a/

└─ 3efbed4aef... ← hello.txt blob

3. `git commit -m "Add hello"`

?? ??:

`.git/objects/`

对象类型	对象内容
tree	指向其他对象的集合 (hello.txt 指向 blob)
commit	指向 tree 对象, 指向父 commit, 包含提交信息

```
.git/objects/  
├─ 3a/... (blob)  
├─ 47/... (tree)  
└─ a1/... (commit)
```

`.git/refs/heads/main`

- 指向当前分支的最新提交

refs/heads/main → a1b2c3d4e5...

`.git/HEAD`

- 指向当前分支的 ref: refs/heads/main → main

`.git/logs/HEAD & logs/refs/heads/main`

- 记录 HEAD 和 refs/heads/main 的提交历史 (reflog)

0000000 → a1b2c3d4 Commit: Add hello

?? ?? (?? 1? ?)

```

Working Directory      ← hello.txt
  ↓ git add
.git/index             ← 100644 00 00
  ↓ git commit
.git/objects/
  ├── blob (100 00)
  ├── tree (100644 00)
  └── commit (100644)

.git/refs/heads/main   ← 100644 → 00 00
  ↑
.git/HEAD              ← 100 100644 00
.git/logs/             ← HEAD/100644 00 00

```

?? ?? (?? ?)

```

cat .git/HEAD
# ref: refs/heads/main

cat .git/refs/heads/main
# a1b2c3d4e5...

git ls-tree HEAD
# 100644 blob 3a3efbed...hello.txt

git cat-file -p <100644>
# tree 47fa...
# author ...
# message: Add hello

```

??

??	??
git add	blob ?? ?? + index ??
git commit	tree + commit ?? ?? , ??? ?? ??

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