Linux file stream exploitation for fun and profit

CONFERENCE

October 2022

SPEAKER
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Summary

1. **Basic understanding**
Review of the main structures

2. **Interesting primitives**
FSOP + demo, "real" ctf contexts

3. **Conclusion**

4. **Questions ?**

1. Basic understanding: _flags


```
struct _IO_FILE
{
  int _flags;       /* High-order word is _IO_MAGIC; rest is flags. */

  /* The following pointers correspond to the C++ streambuf protocol. */
  char *_IO_read_ptr;   /* Current read pointer */
  char *_IO_read_end;   /* End of get area. */
  char *_IO_read_base;  /* Start of putback+get area. */
  char *_IO_write_base; /* Start of put area. */
  char *_IO_write_ptr;  /* Current put pointer. */
  char *_IO_write_end;  /* End of put area. */
  char *_IO_buf_base;   /* Start of reserve area. */
  char *_IO_buf_end;    /* End of reserve area. */

  /* The following fields are used to support backing up and undo. */
  char *_IO_save_base; /* Pointer to start of non-current get area. */
  char *_IO_backup_base;  /* Pointer to first valid character of backup area */
  char *_IO_save_end; /* Pointer to end of non-current get area. */

  struct _IO_marker *_markers;

  struct _IO_FILE *_chain;
```

1. Basic understanding: input buffer


```
struct _IO_FILE
{
  int _flags;       /* High-order word is _IO_MAGIC; rest is flags. */

  /* The following pointers correspond to the C++ streambuf protocol. */
  char *_IO_read_ptr;   /* Current read pointer */
  char *_IO_read_end;   /* End of get area. */
  char *_IO_read_base;  /* Start of putback+get area. */
  char *_IO_write_base; /* Start of put area. */
  char *_IO_write_ptr;  /* Current put pointer. */
  char *_IO_write_end;  /* End of put area. */
  char *_IO_buf_base;   /* Start of reserve area. */
  char *_IO_buf_end;    /* End of reserve area. */

  /* The following fields are used to support backing up and undo. */
  char *_IO_save_base; /* Pointer to start of non-current get area. */
  char *_IO_backup_base;  /* Pointer to first valid character of backup area */
  char *_IO_save_end; /* Pointer to end of non-current get area. */

  struct _IO_marker *_markers;

  struct _IO_FILE *_chain;
```

1. Basic understanding: output buffer


```
struct _IO_FILE
{
  int _flags;       /* High-order word is _IO_MAGIC; rest is flags. */

  /* The following pointers correspond to the C++ streambuf protocol. */
  char *_IO_read_ptr;   /* Current read pointer */
  char *_IO_read_end;   /* End of get area. */
  char *_IO_read_base;  /* Start of putback+get area. */
  char *_IO_write_base; /* Start of put area. */
  char *_IO_write_ptr;  /* Current put pointer. */
  char *_IO_write_end;  /* End of put area. */
  char *_IO_buf_base;   /* Start of reserve area. */
  char *_IO_buf_end;    /* End of reserve area. */

  /* The following fields are used to support backing up and undo. */
  char *_IO_save_base; /* Pointer to start of non-current get area. */
  char *_IO_backup_base;  /* Pointer to first valid character of backup area */
  char *_IO_save_end; /* Pointer to end of non-current get area. */

  struct _IO_marker *_markers;

  struct _IO_FILE *_chain;
```

1. Basic understanding: base buffer


```
struct _IO_FILE
{
  int _flags;       /* High-order word is _IO_MAGIC; rest is flags. */

  /* The following pointers correspond to the C++ streambuf protocol. */
  char *_IO_read_ptr;   /* Current read pointer */
  char *_IO_read_end;   /* End of get area. */
  char *_IO_read_base;  /* Start of putback+get area. */
  char *_IO_write_base; /* Start of put area. */
  char *_IO_write_ptr;  /* Current put pointer. */
  char *_IO_write_end;  /* End of put area. */
  char *_IO_buf_base;   /* Start of reserve area. */
  char *_IO_buf_end;    /* End of reserve area. */

  /* The following fields are used to support backing up and undo. */
  char *_IO_save_base; /* Pointer to start of non-current get area. */
  char *_IO_backup_base;  /* Pointer to first valid character of backup area */
  char *_IO_save_end; /* Pointer to end of non-current get area. */

  struct _IO_marker *_markers;

  struct _IO_FILE *_chain;
```

1. Basic understanding: _chain


```
struct _IO_FILE
{
  int _flags;       /* High-order word is _IO_MAGIC; rest is flags. */

  /* The following pointers correspond to the C++ streambuf protocol. */
  char *_IO_read_ptr;   /* Current read pointer */
  char *_IO_read_end;   /* End of get area. */
  char *_IO_read_base;  /* Start of putback+get area. */
  char *_IO_write_base; /* Start of put area. */
  char *_IO_write_ptr;  /* Current put pointer. */
  char *_IO_write_end;  /* End of put area. */
  char *_IO_buf_base;   /* Start of reserve area. */
  char *_IO_buf_end;    /* End of reserve area. */

  /* The following fields are used to support backing up and undo. */
  char *_IO_save_base; /* Pointer to start of non-current get area. */
  char *_IO_backup_base;  /* Pointer to first valid character of backup area */
  char *_IO_save_end; /* Pointer to end of non-current get area. */

  struct _IO_marker *_markers;

  struct _IO_FILE *_chain;
```

2. Interesting primitives

Powerful primitives ?

2. Interesting primitives

Arbitrary read

```
struct _IO_FILE
{
  int _flags;
  char *_IO_read_ptr;
  char *_IO_read_end;
  char *_IO_read_base;
  char *_IO_write_base;
  char *_IO_write_ptr;
  char *_IO_write_end;
  char *_IO_buf_base;
  char *_IO_buf_end;
  /* The following fields are used to support backing up and undo. */
  char *_IO_save_base; /* Pointer to start of non-current get area. */
  char *_IO_backup_base;  /* Pointer to first valid character of backup area */
  char *_IO_save_end; /* Pointer to end of non-current get area. */

  struct _IO_marker *_markers;

  struct _IO_FILE *_chain;
```

=> _IO_MAGIC | _IO_CURRENTLY_PUTTING | _IO_IS_APPENDING => 0xfbad1800

&target

&target + 8

2. Interesting primitives

FSOP on stdin through unsortedbin attack to overwrite __malloc_hook!

```
struct _IO_FILE
{
  int _flags;


  char *_IO_read_ptr;
  char *_IO_read_end;
  char *_IO_read_base;
  char *_IO_write_base;
  char *_IO_write_ptr;
  char *_IO_write_end;
  char * _IO_buf_base;
  char *_IO_buf_end;

  /* The following fields are used to support backing up and undo. */
  char *_IO_save_base; /* Pointer to start of non-current get area. */
  char *_IO_backup_base;  /* Pointer to first valid character of backup area */
  char *_IO_save_end; /* Pointer to end of non-current get area. */

  struct _IO_marker *_markers;

  struct _IO_FILE *_chain;
```

stdin->_shortbuf

&unsortedbin

3. Conclusion

- The best tools: bootlin, gdb.
- raycp & angelboy
- stderr corruption, _chain hiijacking
- My blog: nasm.re

QUESTIONS ?