Smashing Fun with Smashing Stacks

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CS 316 Section
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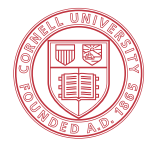

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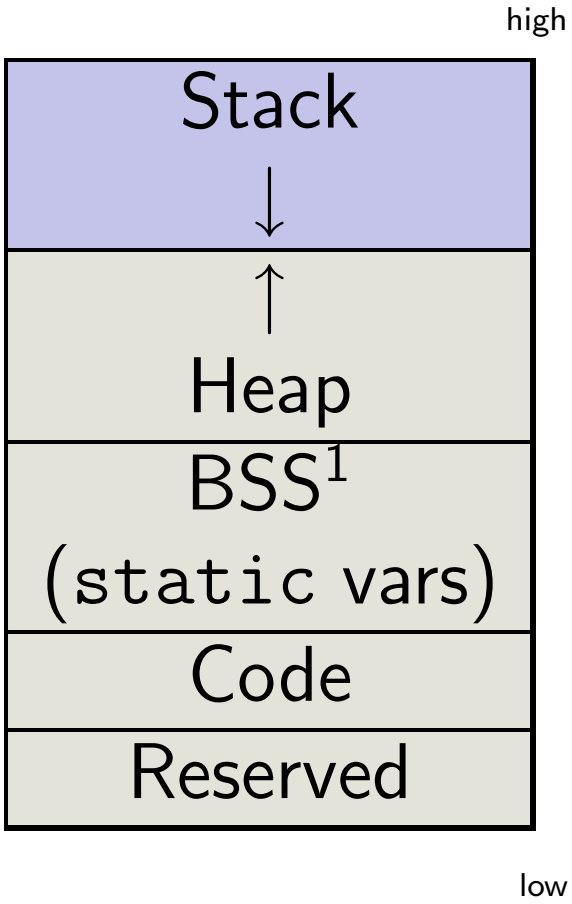
Famous Examples

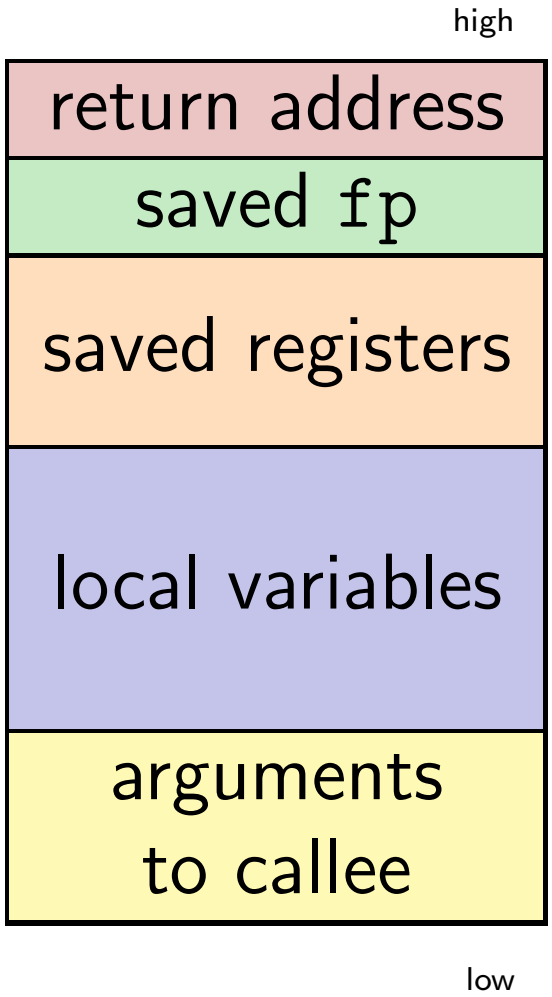
- Morris worm
  - Robert Morris, 2 Nov 1988
  - Spread partly by exploiting `finger`
- Witty worm
  - 19 Mar 2004
  - Exploited BlackICE firewall
  - In $\frac{1}{2}$ hour:
    - Infected 12,000 machines
    - Generated 90 Gb/s UDP traffic
- Slammer worm
  - 25 Jan 2003
  - Exploited Microsoft SQL Server
  - Infected 75,000 machines
    - Most infected within 10 minutes

Program Memory Layout

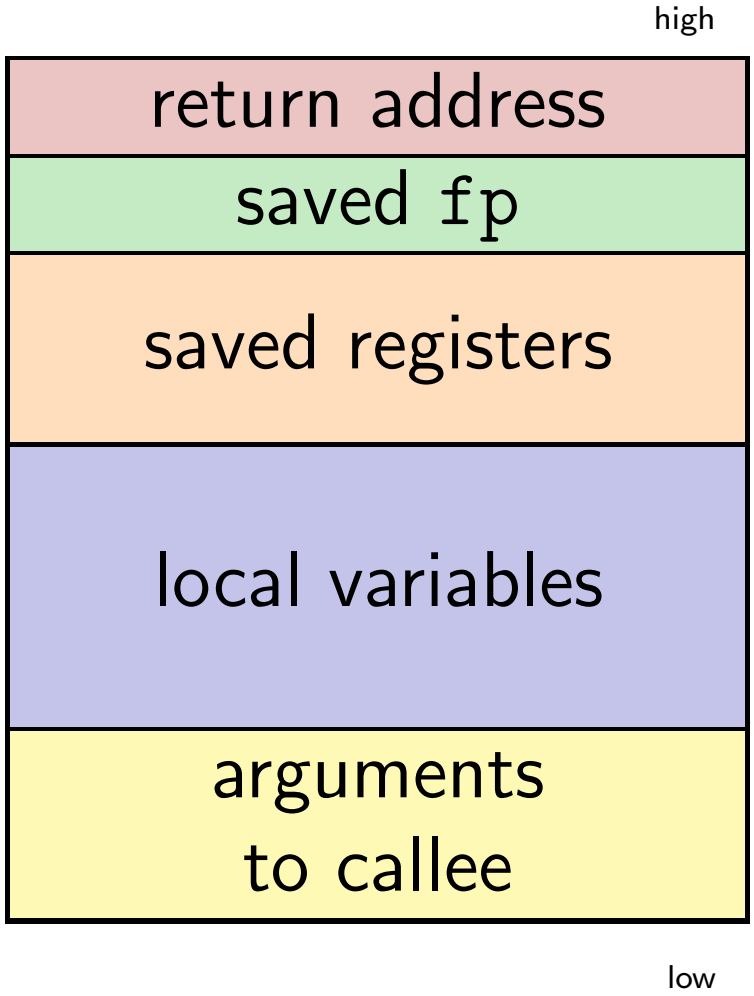


[1] Block Started by Symbol

Stack Frame Layout

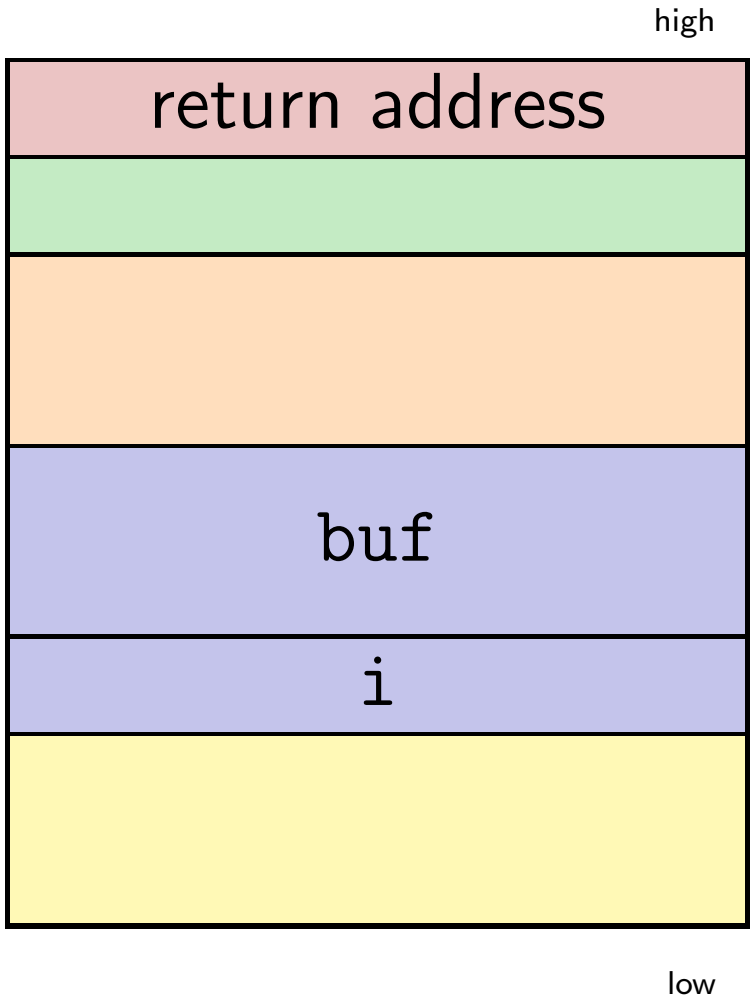


A Buffer Overrun Vulnerability




```
void f(char* str) {
  int i = 0;
  char[8] buf;
  while (str[i] != '\0') {
    buf[i] = str[i];
    i++;
  }
  ...
}
```

A Buffer Overrun Vulnerability

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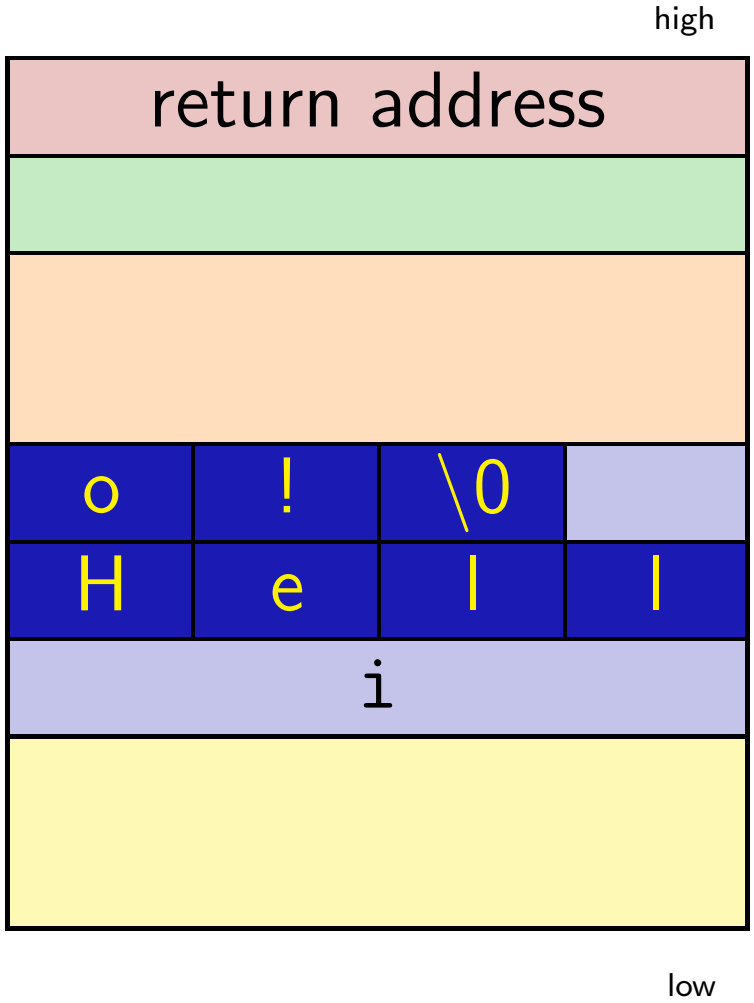
A Buffer Overrun Vulnerability

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  while (str[i] != '\0') {
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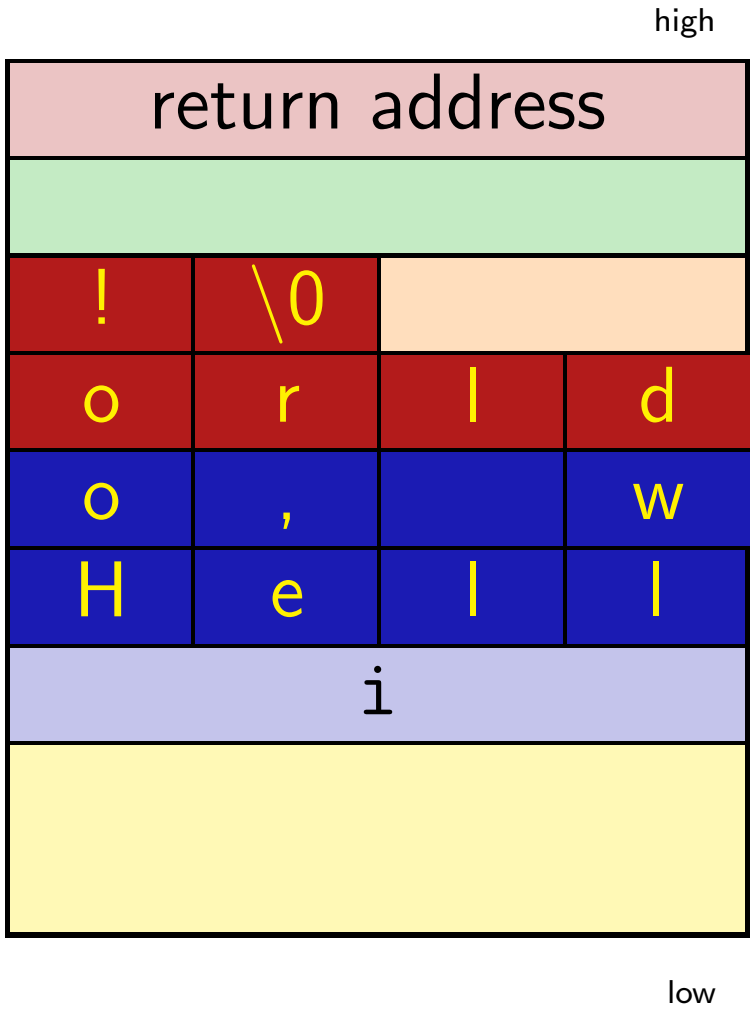
    i++;
  }
  ...
}

void main() {
  f("Hello!");
}
```

A Buffer Overrun Vulnerability

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  char[8] buf;
  while (str[i] != '\0') {
    buf[i] = str[i];
    i++;
  }
  ...
}

void main() {
  f("Hello, world!");
}
```
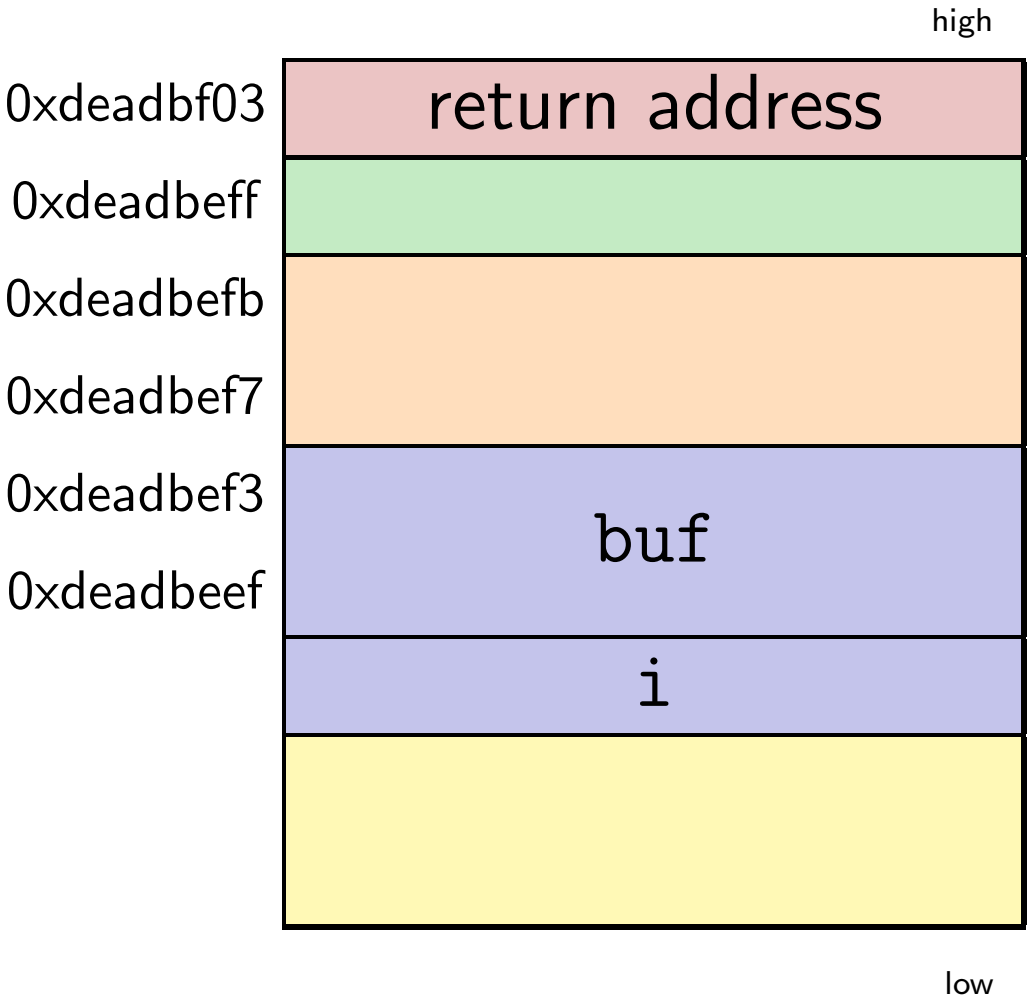
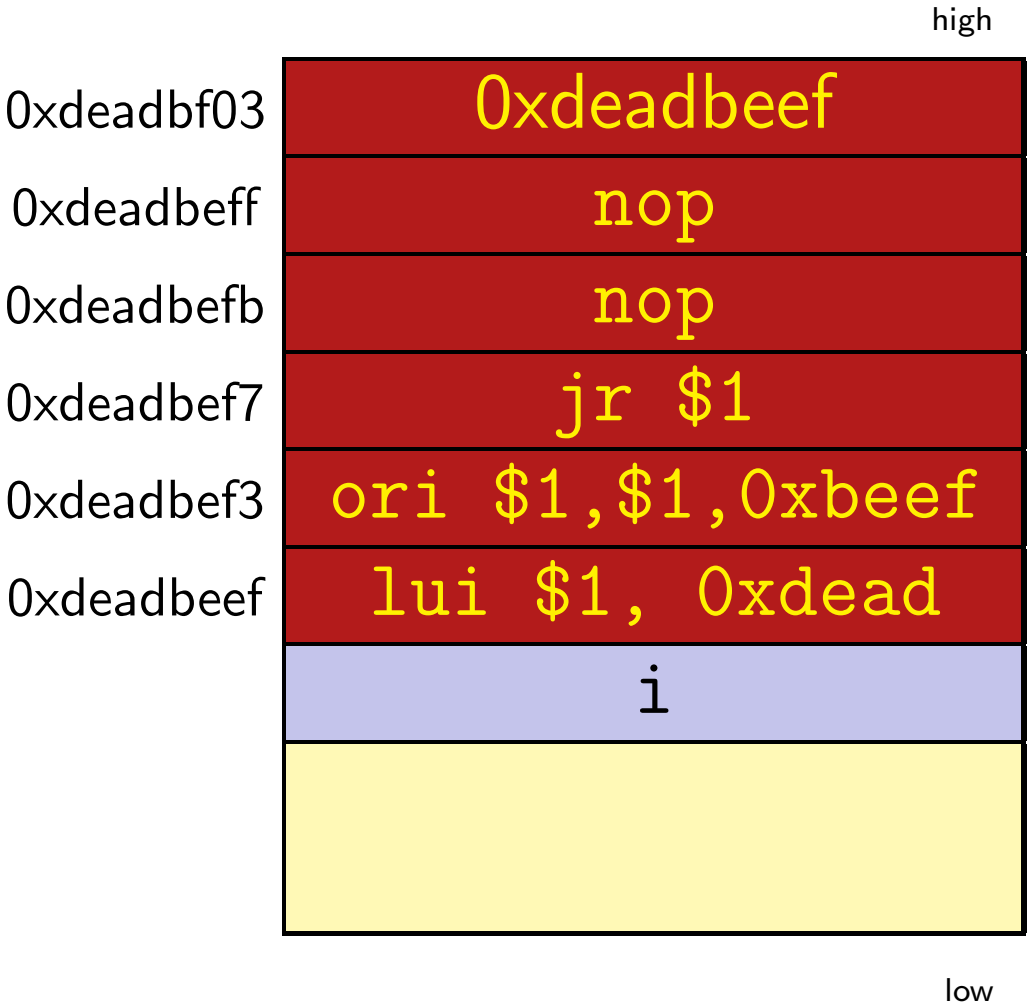

A Buffer Overrun Exploit



A Buffer Overrun Exploit



Countermeasures

Exist at several different levels:

- Programming language
  - Type safety: e.g., Java, Cyclone, Python, ML, ...
- Language library
  - e.g., `strcpy` vs. `strncpy`, `strcpy_s`
- Compiler
  - Static analysis
  - Instrument code w/ runtime checks
  - Insert stack canaries
- OS/Hardware
  - No-execute bit (OS or CPU)
  - Address space layout randomization (OS)
  - Deep packet inspection
    - Check incoming network traffic for signatures