HexVASAN: A Sanitizer for Variadic Functions

hexhive

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Motivation

- Functions that take variable number of arguments are not checked statically, e.g., `int printf(const char*format,…);`
- Vulnerabilities arise from differences between how the caller passes the variadic arguments and how the callee uses them.
- HexVASAN analyzes variadic functions and enforces runtime integrity checks.

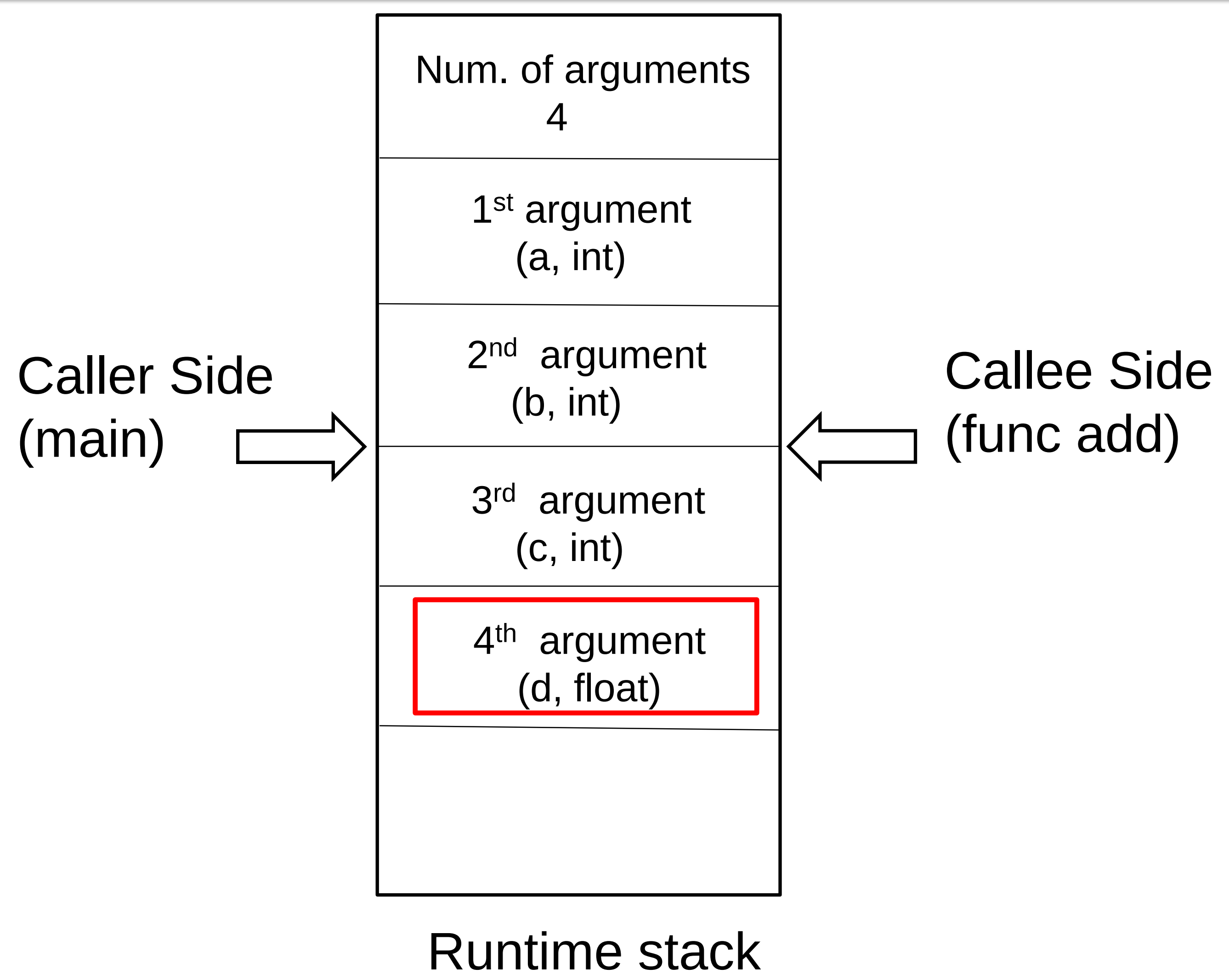
Attack Model

```
printf("%200$p%n", &var)
```

- In a format string attack, an attacker controls the first argument and changes how many parameters are used and interpreted.
- HexVASAN prevents such attacks.

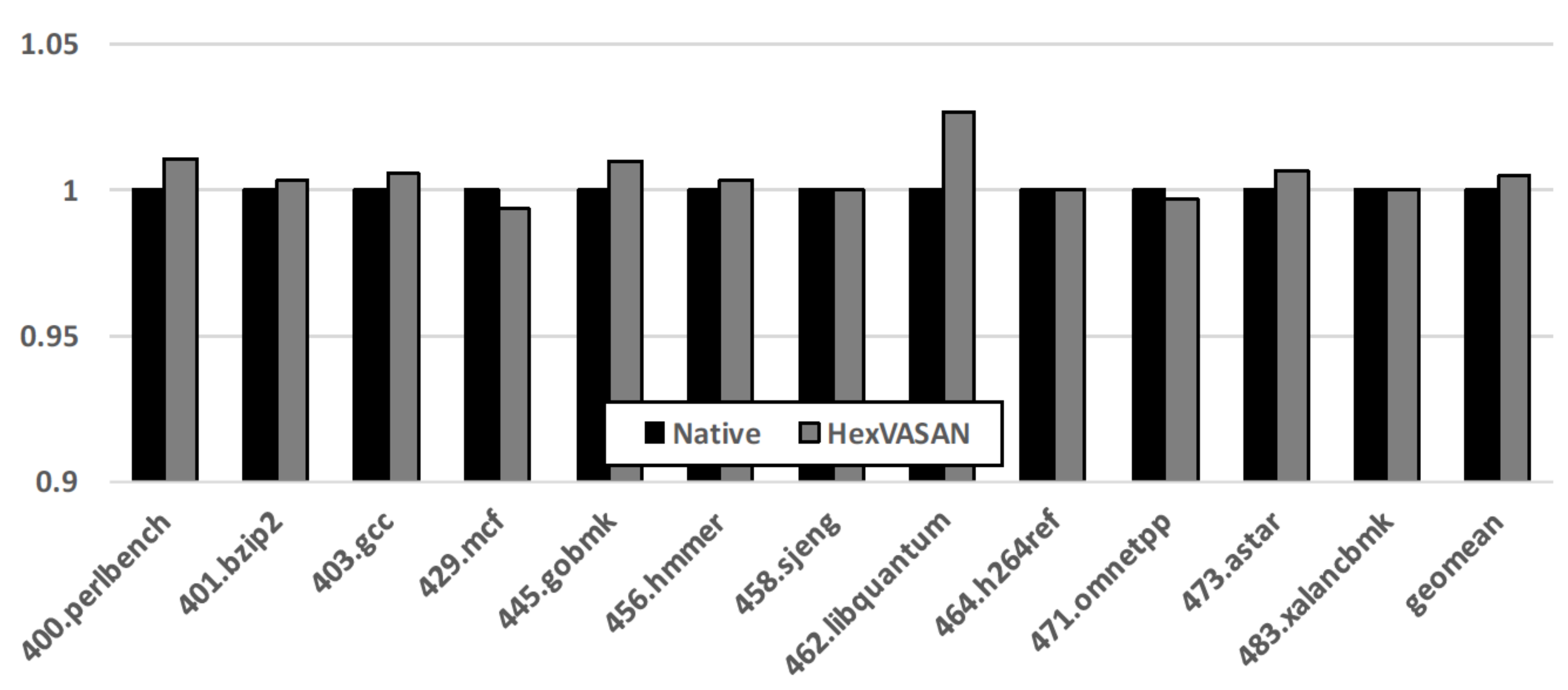
HexVASAN Architecture

```
int add(int n, ...) {
    va_list list;
    va_start(list, n);
    for (int i=0; i < n; i++) {
       total = total + va_arg(list, int);
    }
    va_end(list);
    return total;
}
int main(int argc, const char *argv[])  {
   int a, b, c, result;
   float d;
   result = add(4, a, b, c, d);
   return 0;
}
```



Runtime stack

Result



SPEC CPU2006 overhead (normalized)

Conclusion

- Real software such as Firefox, Chromium uses variadic functions both directly and indirectly, leading to a potential attack surface.
- HexVASAN successfully tracks if there is any type mismatch and prevents exploits.
- Incurs 0.45% and 1% overhead for SPEC CPU2006 and Firefox, respectively.

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