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CVE-2002-0825: Buffer overflow in the DNS resolver functions that perform lookup of network names and addresses, as used in BIND 4.9.8 and ported to glibc 2.2.5 and earlier, allows remote malicious DNS servers to execute arbitrary code through a subroutine used by functions such as getnetbyname and getnetbyaddr.

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“CVE-2002-1219: Buffer overflow in named in BIND 4 versions 4.9.10 and earlier, and 8 versions 8.3.3 and earlier, allows remote attackers to execute arbitrary code via a certain DNS server response containing SIG resource records.

“CVE-2002-0910: Buffer overflows in netstd 3.07-17 package allows remote DNS servers to execute arbitrary code via a long FQDN reply, as observed in the utilities (1) linux-ftpd, (2) pcnfsd, (3) tftp, (4) traceroute, or (5) from/to.

“CVE-2002-0906: Buffer overflow in Sendmail before 8.12.5, when configured to use a custom DNS map to query TXT records, allows remote attackers to cause a denial of service and possibly execute arbitrary code via a malicious DNS server.

“CVE-2002-0825: Buffer overflow in the DNS SRV code for nss_ldap before nss_ldap-198 allows remote attackers to cause a denial of service and possibly execute arbitrary code.

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Documentation said that the data returned from a remote DNS server could contain the requested records and that to exploit this vulnerability, attackers could easily make recursive queries and exploit the cache to look up names inappropriately. This hurt confidentiality and availability: attackers easily see which names have been looked up and attackers easily use cache as a DDoS amplifier.

Nobody had told Symantec about the bailiwick fix.

CVE-2004-1558: The 2004 Symantec Enterprise Firewall DNSD DNS Cache Poisoning Vulnerability: Dnsd does not ensure that the data returned from a remote DNS server contains related information about the requested records. An attacker could exploit this vulnerability to deny service to legitimate users by redirecting traffic to inappropriate hosts. Man-in-the-middle attacks, impersonation of sites, and other attacks may be possible.

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Enterprise Firewall

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Flood of successful attacks, even more than in crypto.

Conventional wisdom: We’ll never stop the flood.

Viega and McGraw: "Because there is no such thing as 100% security, attacks will happen."

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Analogy: “We’ll never build a tunnel from England to France.”

Why not? “It’s impossible.” Or: “Maybe it’s possible, but it’s much too expensive.”

Engineer’s reaction: How expensive is it? How big a tunnel can we build? How can we reduce the costs? Eventually a tunnel was built from England to France.
AES software leaks keys to cache-timing attacks!

True, but we know how to eliminate this problem by (for example) bitslicing.

Maybe secret-key crypto is okay, but large quantum computers will kill public-key cryptography!

If large quantum computers are built, they’ll break RSA and ECC, but we have replacements. See PQCrypto workshops.

Enough crypto for this talk. How about all the rest of computer security?

Flood of successful attacks, even more than in crypto.

Conventional wisdom:
We’ll never stop the flood.

Viega and McGraw: “Because there is no such thing as 100% security, attacks will happen.”

Schneier: “Software bugs (and therefore security flaws) are inevitable.”

Analogy:
“We’ll never build a tunnel from England to France.”

Why not? “It’s impossible.”
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Meta-engineer processes that have lower bug rates. Note: progress is quantified.

Well-known example: Drastically reduce bug rate of typical engineering process by adding coverage tests.
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Example where djbdns did badly:
integer arithmetic.
In C et al.,
a + b usually
means exactly what it says,
but occasionally
doesn’t.
To detect these occasions,
you need to check for overflows.
Extra work for programmer.

To guarantee sane semantics,
consider extending integer range and
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Decompressing those packets produces incorrect results.

Problem for packets that mix data from different sources.

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Tomorrow we’ll make them faster.

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Can architect computer systems to place most of the code into untrusted prisons.

Definition of “untrusted”: no matter what the code does, no matter how badly it behaves, no matter how many bugs it has, it cannot violate the user’s security requirements.

Measure the trusted code volume, and meta-engineer processes that reduce this volume.

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Warning: “Minimizing privilege” rarely eliminates trusted code.

Every security mechanism, no matter how pointless,
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This is not a useful concept.
qmail and djbdns did very badly here: almost all code is trusted.
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What are the user's security requirements?

My fundamental requirement: The system keeps track of sources of data. When the system is asked for data from source /CG, it does not allow data from source /CH to influence the result. Example: When I view an account statement from my bank, I am not seeing data from other web pages or email messages.

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There is no obstacle to centralization and minimization of source-tracking code. Can and should be small enough to eliminate all bugs.

Classic military TCBs used very few lines of code to track (e.g.) Top Secret data. VAX VMM Security Kernel had < 50000 lines of code. Minor programming problem to support arbitrary source labels instead of Top Secret etc.
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“Doesn’t the UNIX/Linux kernel already do this?”

If I log into a system, the kernel copies my uid to my login process, to other processes I start, to files I create, etc.

But if I transfer data to another user’s processes—through the network or a file—the kernel doesn’t remember that I’m the source.
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The system keeps track of sources of data. When the system is asked for data from source /CG, it does not allow data from source /CH to influence the result. Example: When I view an account statement from my bank, I am not seeing data from other web pages or email messages.

There is no obstacle to centralization and minimization of source-tracking code. Can and should be small enough to eliminate all bugs.

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Minor programming problem to support arbitrary source labels instead of Top Secret etc.

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If I log into a system, the kernel copies my uid to my login process, to other processes I start, to files I create, etc.

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All of this code is trusted. All other code in these programs is also trusted, thanks to nonexistent internal partitioning.

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A web-browsing process that reads from mbna.com and from nytimes.com will have both labels. TCB won’t allow process to write /Alice.

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Packet is a string. TCB attaches to the string a microsoft.com source label.

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The cache remembers information in a big associative array.

Post-packet-parsing code tries to store www.google.com in the array.

Cache policy: only root, .com, .google.com, .www.google.com are allowed to store www.google.com information.

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How much code is required for a TCB that enforces source-tracking policy against all other code? How many bugs do we expect in a TCB of this size? Note: Can afford expensive techniques.

If code volume is small enough, and bug rate is small enough, then we will be confident that sources are tracked.
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