IPv6 Security

Where is the challenge?

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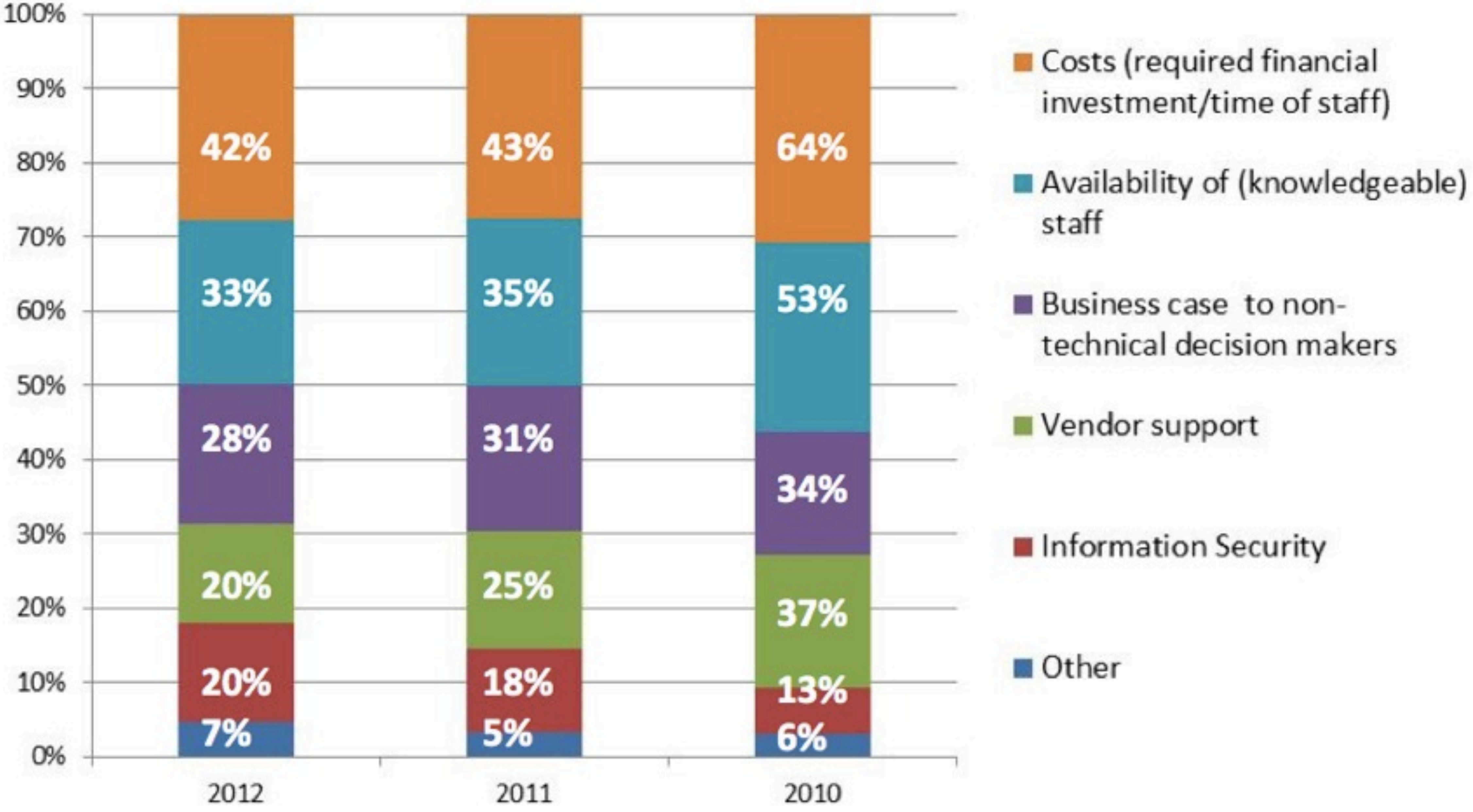
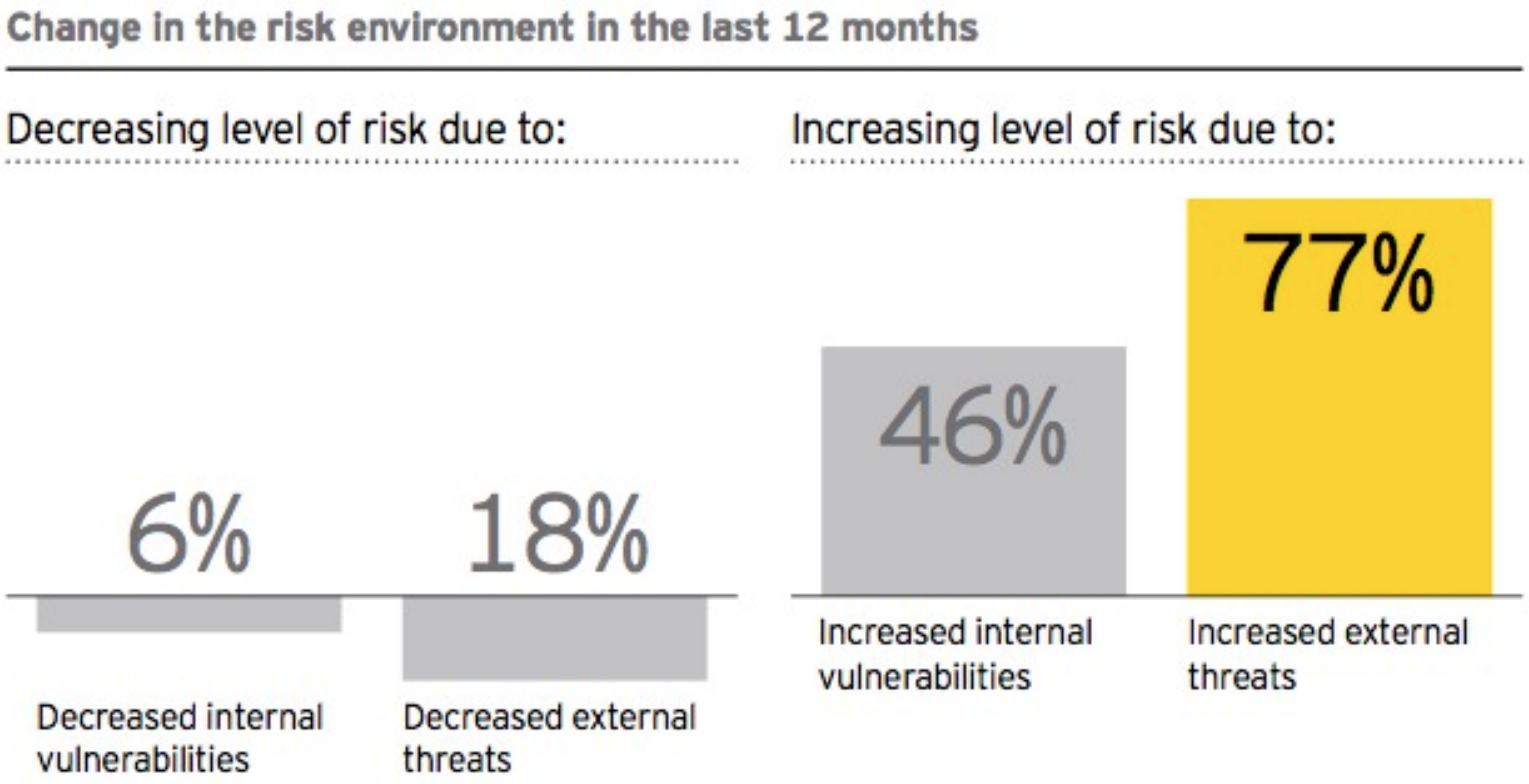
Biggest Hurdle Deploying IPv6



(NRO: Global IPv6 Deployment Survey)

Increased Awareness?



(Ernst & Young: Global Information Security Survey)

Where is the Risk?

Threat or Vulnerability?

- **Threat**: the potential to cause harm
  - DoS, unauthorised access, viruses
- **Vulnerability**: a weakness that can be exploited
  - Bugs, configuration errors, design flaws
- **Risk**: the possibility that a vulnerability will be exploited by somebody to cause harm

Human Factor

- Vulnerabilities exist because of human errors:
  - Coding errors
  - Configuration errors
  - Design flaws
- Doesn’t mean it is **your** fault
  - But a lot of times you can limit the risk

Examples

Is this IPv6 related?

Rogue Router Advertisement

- IPv6 relies on routers to announce themselves using ICMPv6 multicasts
- Protocol has little to no security
- Every machine can claim to be a router
  - Reconfigure clients to another subnet
  - Redirect or intercept traffic

Rogue Router Advertisement (IPv4)

- Every machine can start a DHCP server
  - Reconfigure clients to another subnet
  - Redirect or intercept traffic
  - NAT44 makes it much easier to hide it
- ARP spoofing
  - Pretend I am **the** router by claiming its MAC address

Protection at Protocol Layer

- “RA Guard” feature
  - Filter route announcements on switches
  - On all ports except for the known router
  - Present in a lot of equipment already
- SEcure Neighbor Discovery (SEND)
  - Fix the protocol by adding verification
  - Add cryptographic certificates and signatures
  - **No widespread implementation**

What About Layer 2?

- Securing access to the physical network:
  - 802.1x authentication
  - Disable unused ports on switches
  - Strengthen wireless passwords
  - MAC address counters or filters (port security)
- Lowers the risk for both protocols
  - Can protect for other vulnerabilities

Another Example

ND Table Exhaustion

- An IPv6 subnet contains 2^{64} addresses
- Scanning the range triggers neighbor discovery messages to be send out
- Can result in denial of service:
  - Too many packets
  - High CPU load
  - Exhaust available memory

“Ping Pong Issue”

- Can happen on point-to-point links that don’t use neighbor discovery (i.e. Sonet)
- Packet destined for a non-existing address on the point-to-point will bounce between the two routers
- Exists in IPv4 as well
  - But we learned to use small prefixes (/30, /31)

Smurf Attack (IPv4)

- Send a (spoofed) ICMP ping to a network broadcast address
- Multiple replies go to the source, causing a denial of service

ARP Flooding

- There are 2^{48} MAC addresses possible
  - Minus a few reserved or in use
- Send a number of packets while changing the source MAC address:
  - Switch will run out of memory
  - Floods all packets to all ports

IPv6-Specific Measures

- ICMPv6 protocol changed in March 2006
  - Prevents “ping pong” issue
- Filter or rate limit ICMPv6 Neighbor Discovery
  - **Not advisable, makes the attack easier**
- Do they really need to talk to you?
  - Filter/rate limit inbound TCP syn packets
  - Rate limit inbound ICMPv6 (**do not block!**)
- Use of /127 on point-to-point links

Local Attacks Still Possible

- Securing access to the physical network:
  - 802.1x authentication
  - Disable unused ports on switches
  - Strengthen wireless passwords
  - MAC address counters or filters (port security)
- Lowers the risk for both protocols
  - **Can protect for other vulnerabilities**

Upper Layers

Where are you?

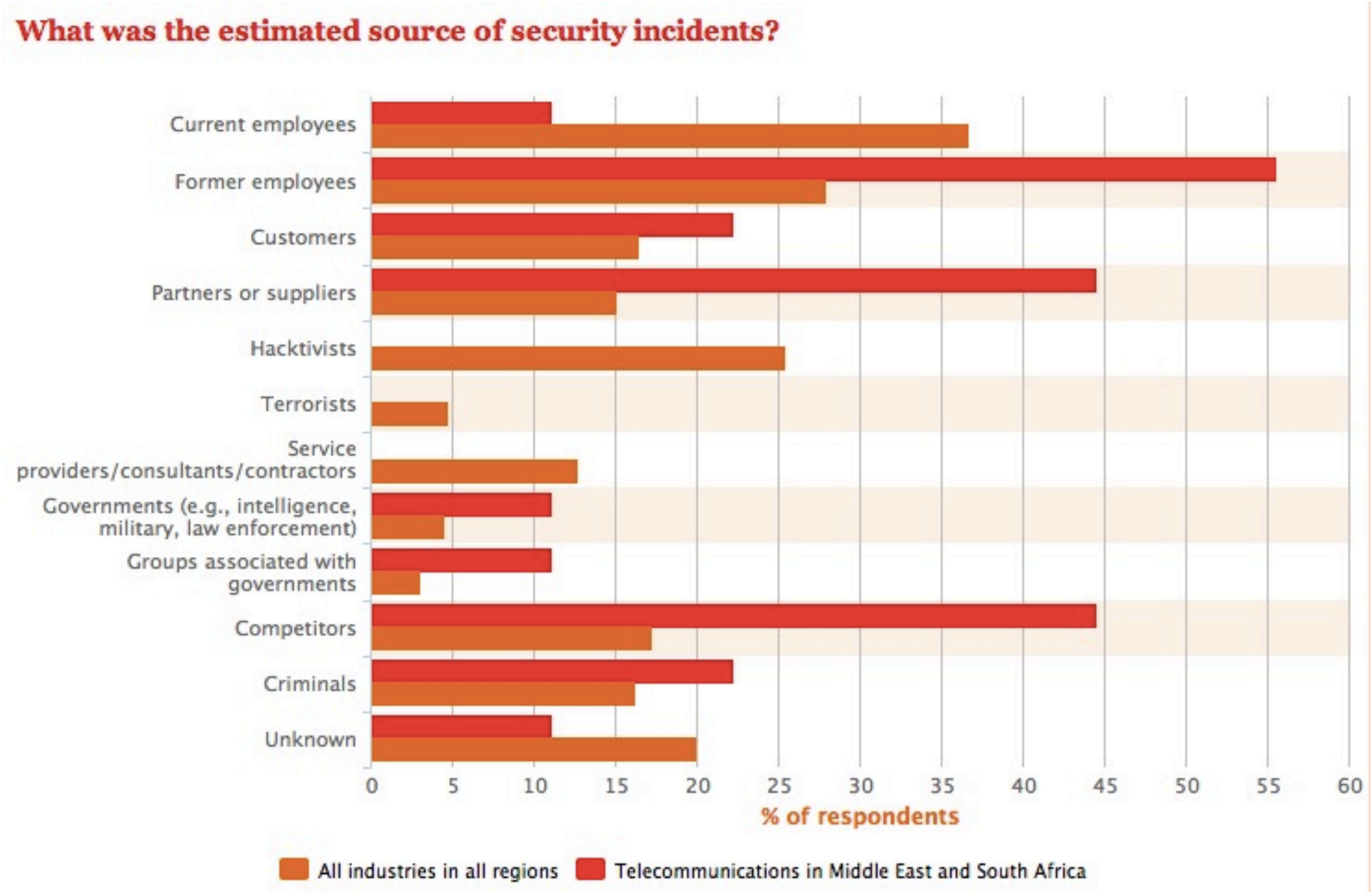
Vulnerabilities are Everywhere

- Most security incidents caused in the application layers:
  - Buffer overflows
  - SQL injection
  - Man-in-the-middle attacks
  - Weak authentication

General Prevention Methods

- Don’t run any unnecessary services
- Keep up to date with software patches
- Use encryption where possible
- Use two-factor authentication
- Keep it simple

Source of Incidents



(PWC: Information Security Survey)

The Human Factor

- Attacks are triggered by somebody

- Known vulnerabilities are ignored

- Mistakes can and will happen

Capacity Building

- Test your implementations before deploying
  - Don’t rely on the glossy brochure
- Build up knowledge
  - Learn to identify potential risks
  - Learn how to deal with them
- Make use of available resources
  - Training courses and tutorials
  - **Share your experiences**

Improving Security with IPv6

- Multiple subnets makes it easier to separate functions or people
- Lack of NAT
  - Makes everything much more visible
  - Security moves to the end hosts
  - Forces you to think
- Somebody might already use IPv6!
  - Using tunnels to hide what is going on

Conclusion

- IPv6 might add some vulnerabilities
- IPv6 is not a threat
- You are the biggest risk

Questions?

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