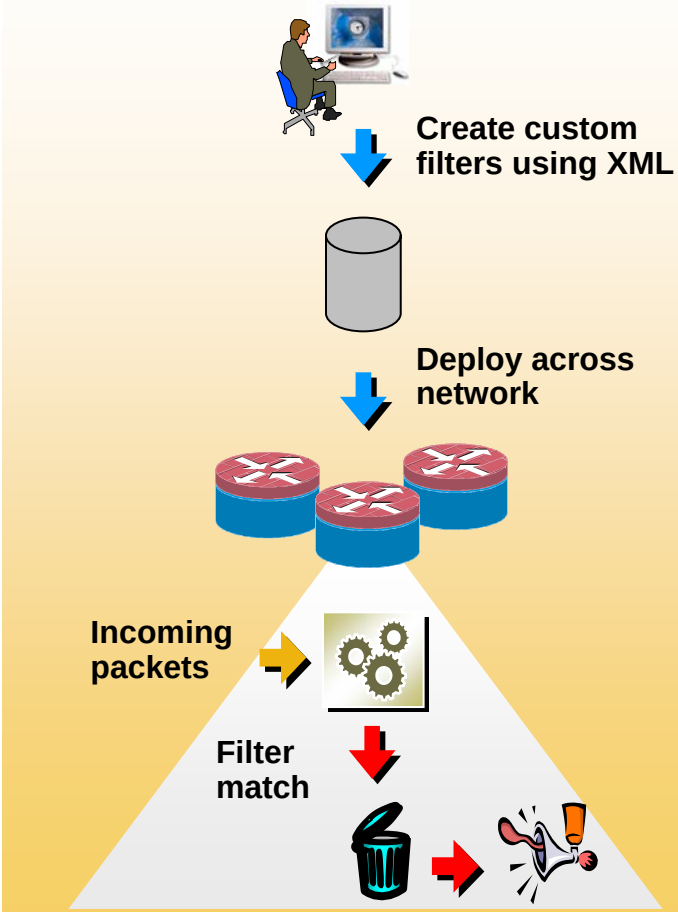
Flexible Packet Matching

Mitigating Attacks with Flexible Packet Matching (FPM)

- **Next generation "Super ACL" pattern matching capability for more granular and customized packet filters**
- **Ability to match on arbitrary bits of a packet at arbitrary depth (offset) in the packet header and payload.**
  - **Detects malicious patterns deep within the packet**
- **Provision via CLI or off-box via XML**
- **Easier and faster to deploy**
  - **Filters can be unstructured allowing customers to respond quickly**
  - **Filters install on routers without reload**
- **Platform support:**
  - **800–3845, 7200, 7301**

Network-based blocking of known threats and attacks



The Problem

- **Attacks are getting sophisticated—we need the ability to classify on multiple attributes within a packet**

  Example: Slammer's signature was a combination of port 1434, a packet length of 404 bytes, and a byte pattern within payload

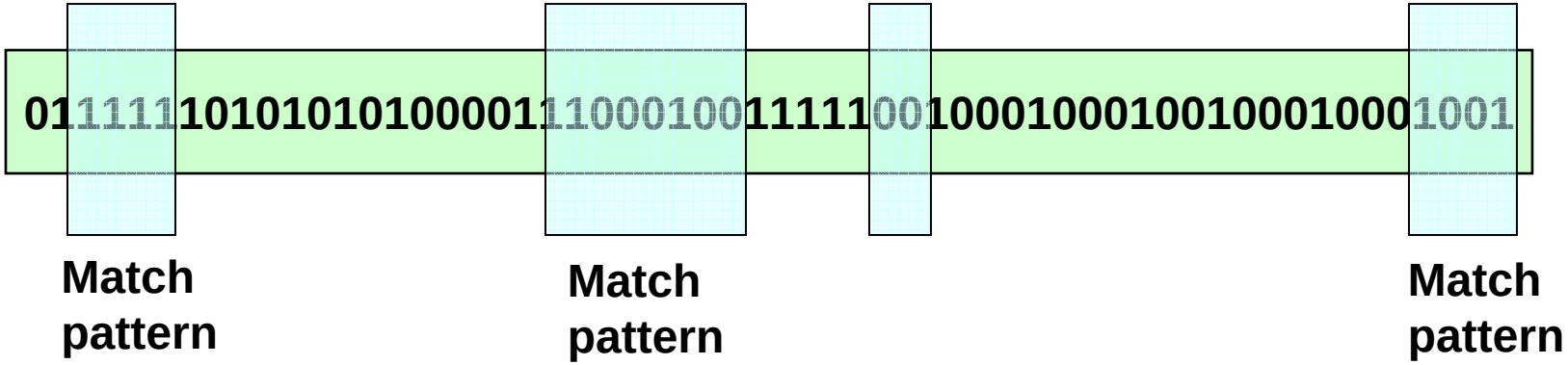
- **We need the ability to rapidly define and deploy classification and filtering mechanisms to mitigate new attacks**

  Current classification and filtering capabilities are traditionally limited to a field or specific to an event, and are developed one at a time

The Solution—What Is Needed?

A versatile, powerful and rapidly deployable classification and filtering mechanism to complement and bridge the gap between existing mechanisms such as ACLs, NBAR, IPS signatures and Cisco guard Anomaly Detection filters.

Flexible Packet Matching
Functionality



- **Ability to match on arbitrary bits of a packet at arbitrary depth (offset) in the packet**
- **Today supports a depth of 256 bytes**
- **Layer 2–Layer 7 stateless classification and match capability**

Flexible Packet Matching (FPM)
Overview

- Enhancement to existing Cisco® ACL functionality
- Users can define customized classification criteria for stateless traffic
- Once an attack vector is determined, FPM provides the ability to define the filtering (match) criteria against any portion of the packet
- Classification is based on multiple bit matching patterns and regular expression matches across the packet
- Supported on all access platforms: 800–3845, 7200, 7301

Flexible Packet Matching Overview (cont.)

- **Describe packet filters using Class-Based Policy Language (CPL), CLI, or XML (TCDF)**
- **Define customized protocol header definition files (PHDFs)**
  - **Support for defining PHDFs via XML**
  - **CLI provides descriptors for various fields within protocol header such as IP, IP options, TCP, UDP**
  - **PHDFs can be uploaded at run time**
- **Standard PHDFs can be downloaded from CCO:**
  - **At FCS: IP, UDP, TCP, ICMP, Ethernet**
  - **Coming: SNMP, HTTP, SMTP, DNS, GRE, IPSec**
- **Basic flexible packet matching filter actions:**
  - **Drop**
  - **Log**
  - **ICMP-Unreachable**

Basic FPM Capability
Filter Match Operators

- **Relational operators**
  - **Eq, NEq, Gt, Lt, GE, LE**
  - **Support bit mask**
- **Logical operators**
  - **AND, OR**
- **String, match, and regular expressions**
  - **Not the same regular expressions as BGP, but a subset; uses the same regular expression engine as IPS and NBAR**
- **Arithmetic expressions for offsets on variable header length**
- **Values can be entered in decimal or hexadecimal**

Flexible Packet Matching Use Case
Slammer Filter

```
rtr(config)# class-map type stack match-all ip_udp
    rtr(config-cmap)# description “match UDP over IP packets”
    rtr(config-cmap)# match field ip protocol eq 17 next udp

rtr(config)# class-map type access-control match-all slammer
    rtr(config-cmap) # description “match on slammer packets”
    rtr(config-cmap)# match field udp dest-port eq 1434
    rtr(config-cmap)# match field ip length eq 404
    rtr(config-cmap)# match start l3-start offset 224 size 4 eq 0x04010101

    rtr(config)# policy-map type access-control fpm_udp_policy
    rtr(config-pmap)# description “policy for UDP based attacks”
    rtr(config-pmap)# class slammer
    rtr(config-pmap-c)# drop

    rtr(config)# policy-map type access-control fpm_policy
    rtr(config-pmap)# description “drop worms and malicious attacks”
    rtr(config-pmap)# class ip_udp
    rtr(config-pmap-c)# service-policy fpm_udp_policy

    rtr(config)# interface gigabitEthernet 0/1
    rtr(config-if)# service-policy type access-control input fpm_policy
```

Stack class defines IP—UDP protocol stack

Access-control class defines traffic pattern

UDP destination port eq 1434

4B string pattern 0x04010101 at 224B offset from IP header

Drop all packets matching class slammer

Apply input/output service policy on per interface basis

How Do I Use FPM?

- **To prepare, download the PHDFs from CCO and load them onto your routers (IP, TCP, UDP, Ethernet)**
- **Minute zero: Determine that anomalous traffic is entering your network (sniffer traces, NetFlow)**
- **Inspect the packet structure of the anomalous traffic**
- **If you can use an ACL to mitigate it, use it!**
- **If you cannot use an ACL because it might block legitimate business traffic, use FPM to classify your traffic and assign an action to the policy: Drop, Log, ICMP-Unreachable**
- **If it is attack traffic, IPS, CICS will have updates coming along soon, but in those first few hours, use ACL/FPM**

Reference

- **FPM on the Cisco® Website**
  http://www.cisco.com/go/fpm
- **Protocol header definition files**
  http://www.cisco.com/cgi-bin/tablebuild.pl/fpm
- **FPM deployment guide**
  http://www.cisco.com/en/US/products/ps6642/products_white_paper0900aecd803936f6.shtml