



# CISCO IOS NETFLOW OVERVIEW

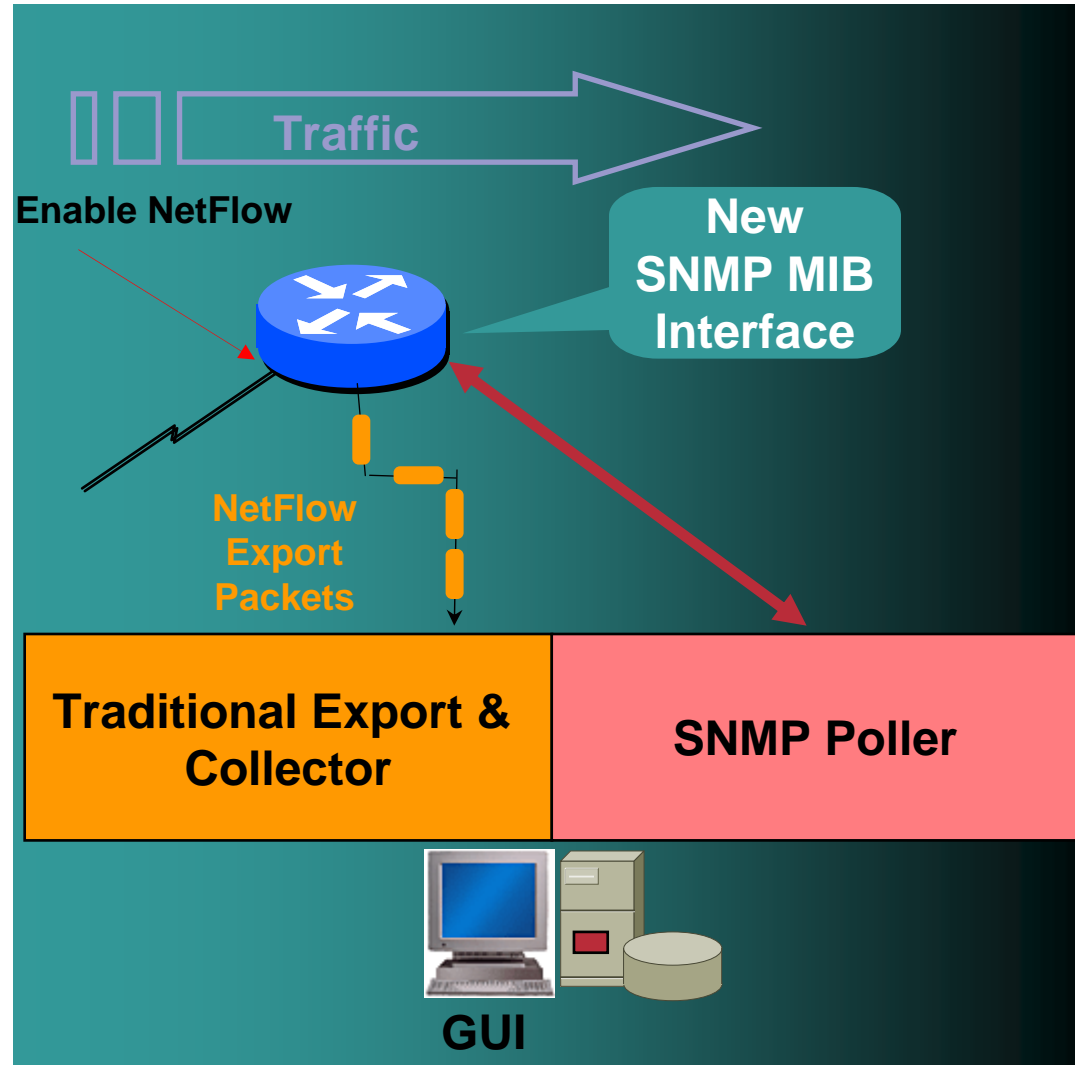
**ITD PRODUCT MANAGEMENT  
FEBRUARY 2004**

# Cisco IOS NetFlow Origination

- Developed and patented at Cisco® Systems in 1996
- NetFlow is now the **primary network accounting technology** in the industry
- Answers questions regarding IP traffic: **who, what, where, when, and how**
- Provides a **detailed view** of network behavior

# Flow Is Defined By Seven Unique Keys

- Source IP address
- Destination IP address
- Source port
- Destination port
- Layer 3 protocol type
- TOS byte (DSCP)
- Input logical interface (ifIndex)



# NetFlow Cache Example

## 1. Create and update flows in NetFlow Cache

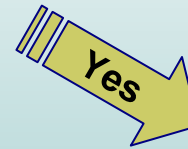
| SrcIfl | SrcIPadd     | DstIfl | DstIPadd    | Protocol | TOS | Flgs | Pkts  | SrcPort | SrcMsk | SrcAS | DstPort | DstMsk | DstAS | NextHop   | Bytes/Pkt | Active | Idle |
|--------|--------------|--------|-------------|----------|-----|------|-------|---------|--------|-------|---------|--------|-------|-----------|-----------|--------|------|
| Fa1/0  | 173.100.21.2 | Fa0/0  | 10.0.227.12 | 11       | 80  | 10   | 11000 | 00A2    | /24    | 5     | 00A2    | /24    | 15    | 10.0.23.2 | 1528      | 1745   | 4    |
| Fa1/0  | 173.100.3.2  | Fa0/0  | 10.0.227.12 | 6        | 40  | 0    | 2491  | 15      | /26    | 196   | 15      | /24    | 15    | 10.0.23.2 | 740       | 41.5   | 1    |
| Fa1/0  | 173.100.20.2 | Fa0/0  | 10.0.227.12 | 11       | 80  | 10   | 10000 | 00A1    | /24    | 180   | 00A1    | /24    | 15    | 10.0.23.2 | 1428      | 1145.5 | 3    |
| Fa1/0  | 173.100.6.2  | Fa0/0  | 10.0.227.12 | 6        | 40  | 0    | 2210  | 19      | /30    | 180   | 19      | /24    | 15    | 10.0.23.2 | 1040      | 24.5   | 14   |

## 2. Expiration

- Inactive timer expired (15 sec is default)
- Active timer expired (30 min (1800 sec) is default)
- NetFlow cache is full (oldest flows are expired)
- RST or FIN TCP Flag

| SrcIfl | SrcIPadd     | DstIfl | DstIPadd    | Protocol | TOS | Flgs | Pkts  | SrcPort | SrcMsk | SrcAS | DstPort | DstMsk | DstAS | NextHop   | Bytes/Pkt | Active | Idle |
|--------|--------------|--------|-------------|----------|-----|------|-------|---------|--------|-------|---------|--------|-------|-----------|-----------|--------|------|
| Fa1/0  | 173.100.21.2 | Fa0/0  | 10.0.227.12 | 11       | 80  | 10   | 11000 | 00A2    | /24    | 5     | 00A2    | /24    | 15    | 10.0.23.2 | 1528      | 1800   | 4    |

## 3. Aggregation?



e.g. Protocol-Port Aggregation Scheme becomes

| Protocol | Pkts  | SrcPort | DstPort | Bytes/Pkt |
|----------|-------|---------|---------|-----------|
| 11       | 11000 | 00A2    | 00A2    | 1528      |

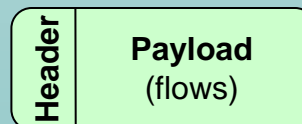
## 4. Export Version

Non-Aggregated Flows – export **Version 5 or 9**

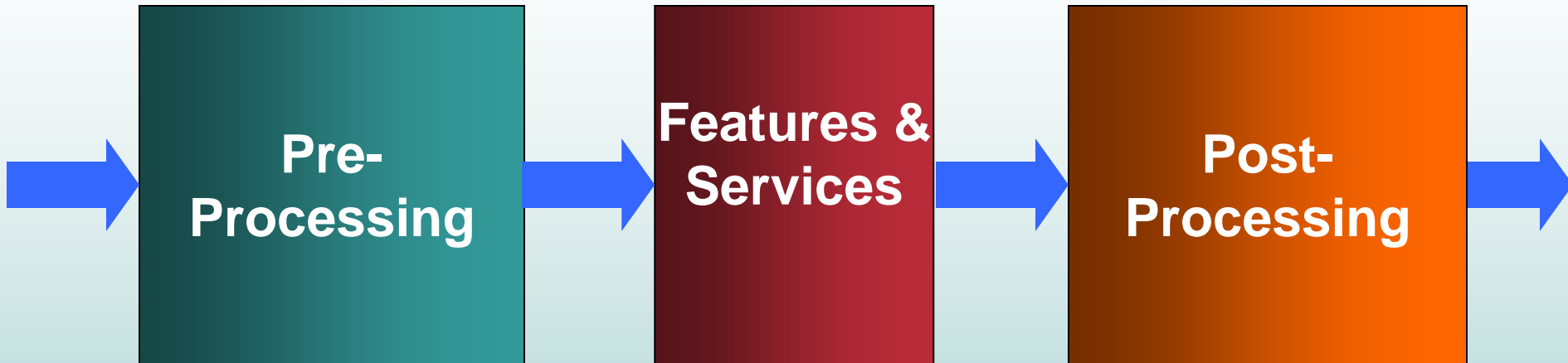
Aggregated Flows – export **Version 8 or 9**

## 5. Transport Protocol

Export Packet



# NetFlow Processing Direction



- **Packet Sampling**
- **Filtering**

- **IP**
- **Multicast**
- **MPLS**
- **IPv6**

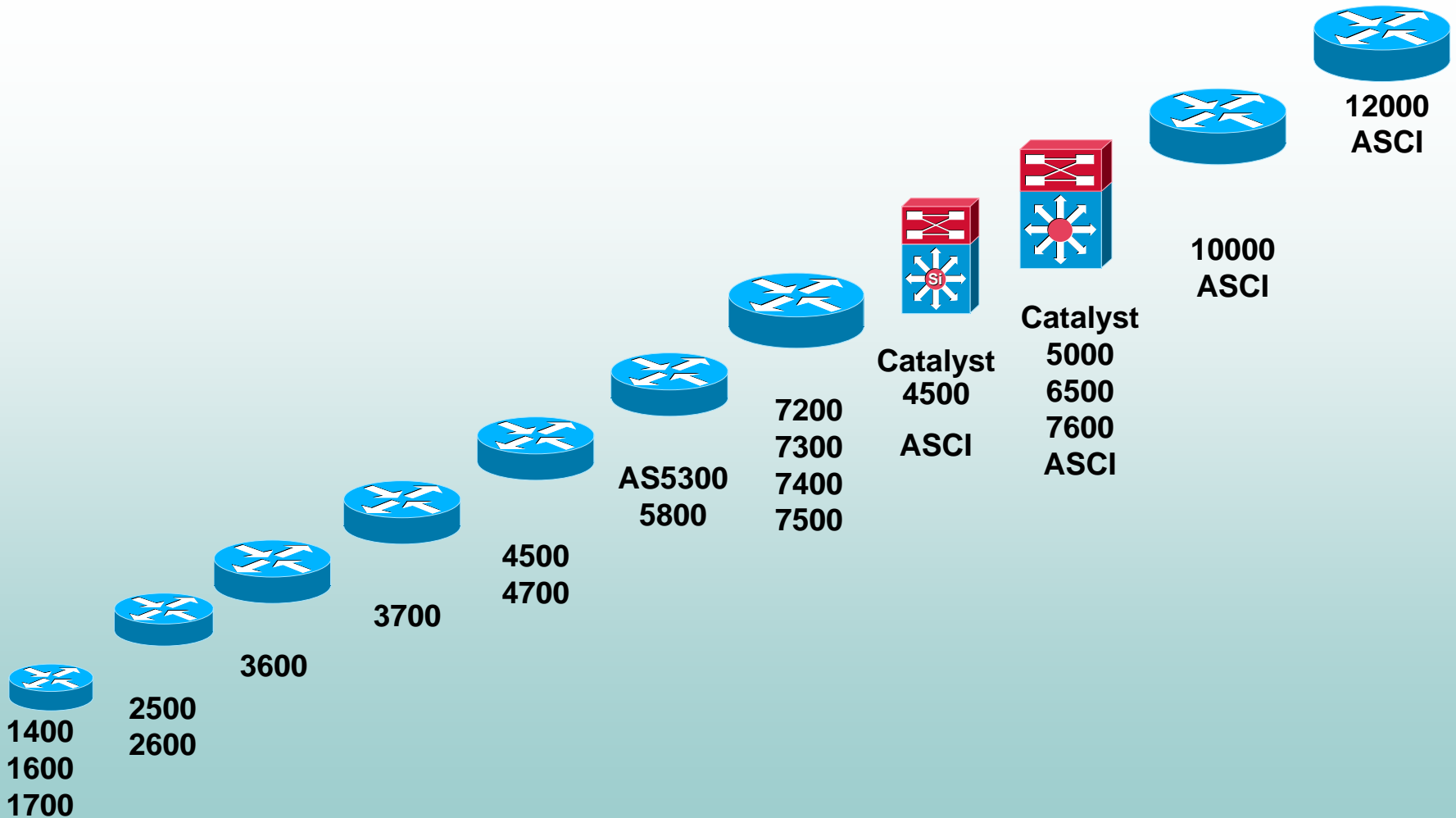
- **Aggregation schemes**
- **Export**

# NetFlow Principles

- **Inbound traffic only today**
- **Unidirectional flow**
- **Accounts for both transit traffic and traffic destined for the router**
- **Works with Cisco Express Forwarding or fast switching**
  - Not a switching path
- **Supported on all interfaces and Cisco IOS Software hardware products**
- **Returns the sub-interface information in the flow records**

# Comprehensive Hardware Support

Cisco.com



# Principle Netflow Benefits

## Service Provider

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- Peering arrangements
- Network Planning
- Traffic Engineering
- Accounting and billing
- Security Monitoring

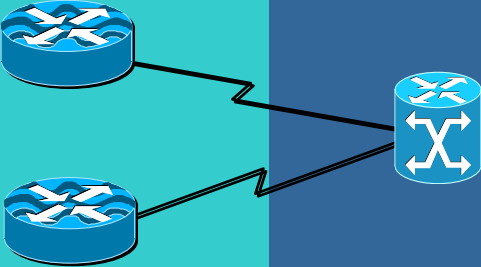


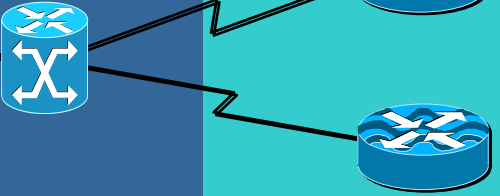

## Enterprise

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- Internet access monitoring (protocol distribution, where traffic is going/coming)
- User Monitoring
- Application Monitoring
- Charge Back billing for departments
- Security Monitoring



# NetFlow Uses

|                         | Access   | Distribution  | Core  | Distribution  | Access   |
|-------------------------|--|---|---|---|--|
| <b>Network Layer</b>    |   |   |   |    |   |
| <b>Applications</b>     | <ul style="list-style-type: none"> <li>• Attack Mitigation</li> <li>• User (IP) monitoring</li> <li>• Application monitoring</li> </ul>        | <ul style="list-style-type: none"> <li>• Billing</li> <li>• Chargeback</li> <li>• AS Peer Monitoring</li> </ul>                                   | <ul style="list-style-type: none"> <li>• Traffic Engineering</li> <li>• Traffic Analysis</li> </ul>                                 | <ul style="list-style-type: none"> <li>• Billing</li> <li>• Chargeback</li> <li>• AS Peer Monitoring</li> </ul>                                   | <ul style="list-style-type: none"> <li>• Attack Mitigation</li> <li>• User (IP) monitoring</li> <li>• Application monitoring</li> </ul>        |
| <b>NetFlow Features</b> | <ul style="list-style-type: none"> <li>• Aggregation Schemes (v8)</li> <li>• “show ip cache flow” command</li> <li>• Arbor Networks</li> </ul> | <ul style="list-style-type: none"> <li>• NetFlow MPLS Egress Accounting</li> <li>• BGP Next-hop (v9)</li> <li>• Multicast NetFlow (v9)</li> </ul> | <ul style="list-style-type: none"> <li>• MPLS Aware NetFlow (v9)</li> <li>• BGP Next-hop (v9)</li> <li>• Sampled NetFlow</li> </ul> | <ul style="list-style-type: none"> <li>• NetFlow MPLS Egress Accounting</li> <li>• BGP Next-hop (v9)</li> <li>• Multicast NetFlow (v9)</li> </ul> | <ul style="list-style-type: none"> <li>• Aggregation Schemes (v8)</li> <li>• “show ip cache flow” command</li> <li>• Arbor Networks</li> </ul> |

# Tracking Users

**Who are the top users?  
How long are the users on the network?**

**What Internet sites do they use?  
Where do the users go on the network?**

**What percentage of traffic do they use?  
What applications do they use?  
What are the user usage patterns?**

# NetFlow for Security: Flow Information Helps Mitigate Attacks

- **Identify the attack**

  - Count the Flows

  - Inactive flows signal a worm attack

- **Classify the attack**

  - Small size flows to same destination

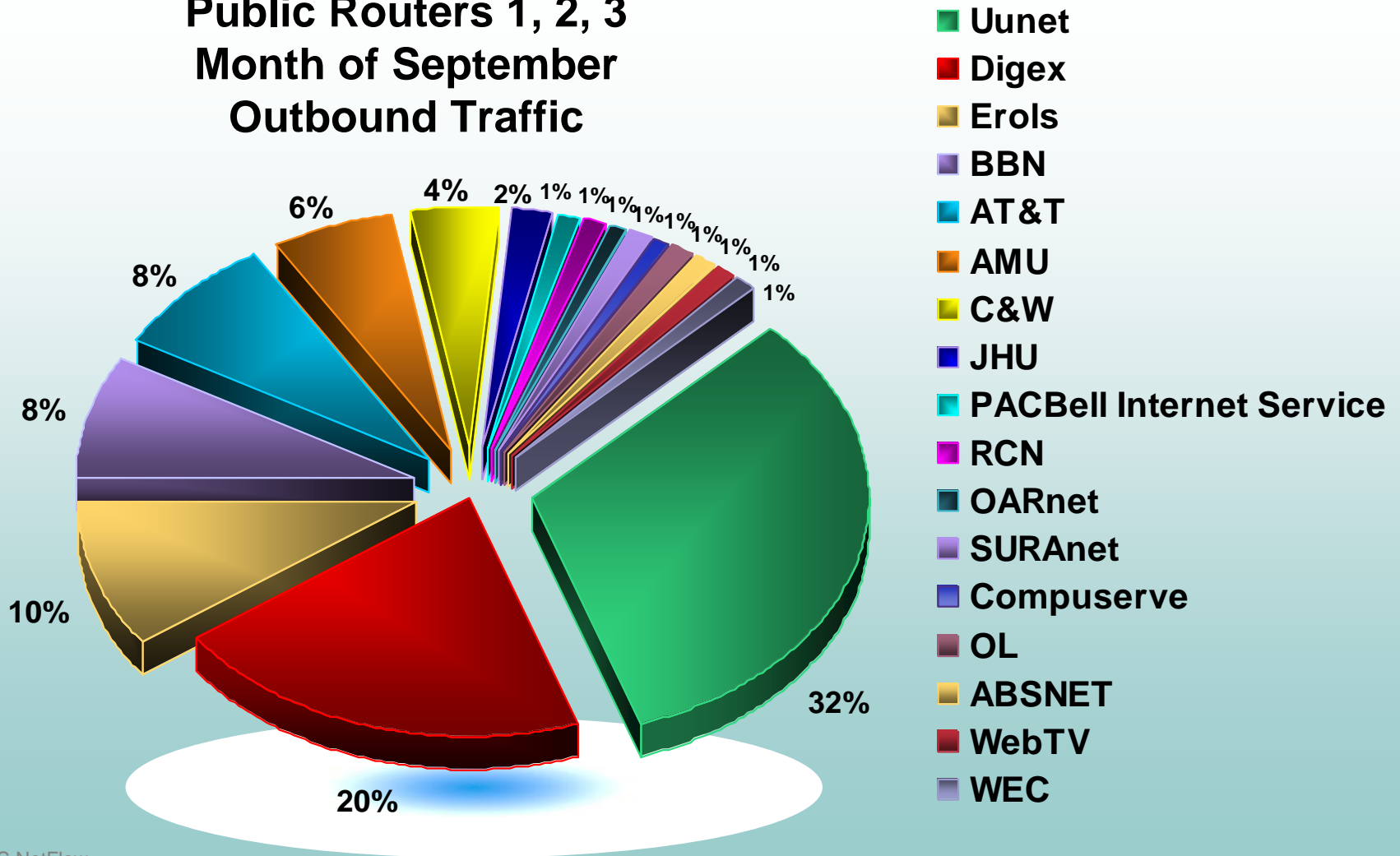
  - What is being attacked and origination of attack

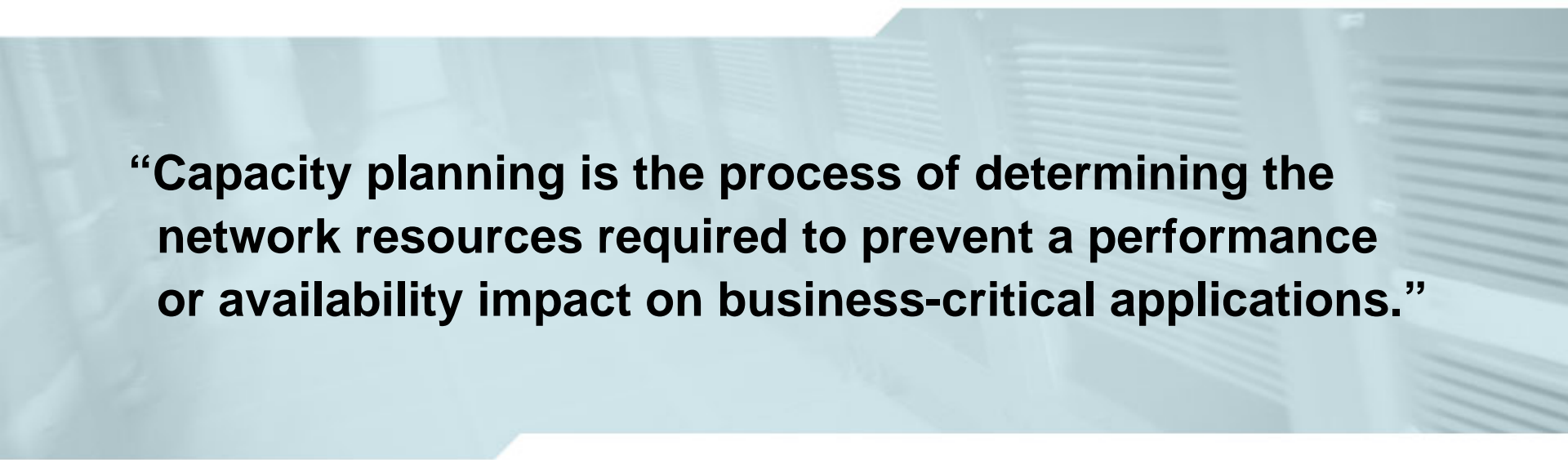
- **Cisco IT prevented SQL slammer at Cisco by watching flows per port**

- **Flat-rate billing does not necessarily scale**
  - Competitive pricing models can be created with usage-based billing
- **Usage-based billing considerations**
  - Time of day
  - Within or outside of the network
  - Application
  - Distance-based
  - Quality of Service (QoS) / Class of Service (CoS)
  - Bandwidth usage
  - Transit or peer
  - Data transferred
  - Traffic class

# NetFlow – Peering Agreement

**Public Routers 1, 2, 3  
Month of September  
Outbound Traffic**





**“Capacity planning is the process of determining the network resources required to prevent a performance or availability impact on business-critical applications.”**

# Capacity Planning

- **Key areas to monitor**

  - Application usage**

  - Identify which applications consume bandwidth**

  - Who are the top ten nodes that consume bandwidth**

- **Output data circuit forecasts**

- **Current network utilization and capacity being used**

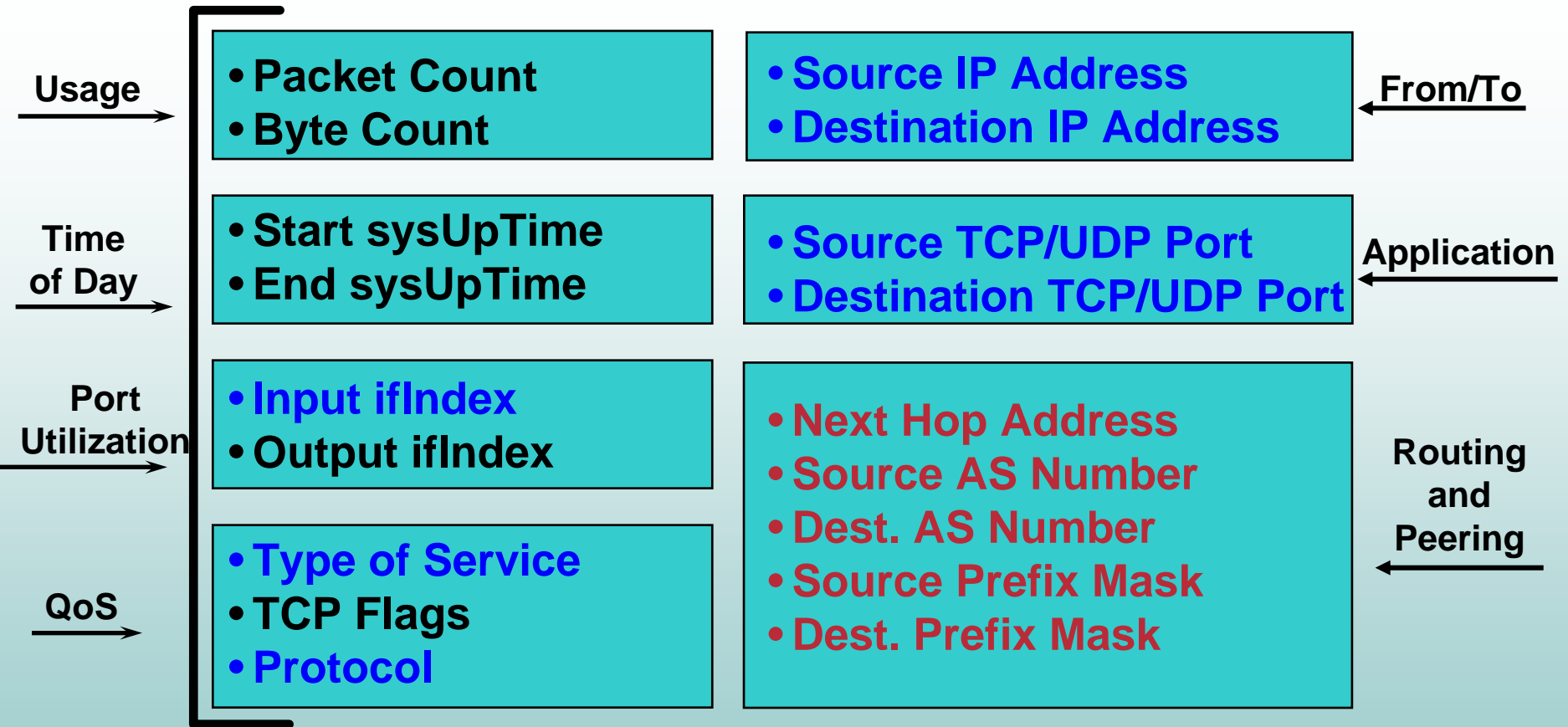
# NetFlow Versions

| NetFlow Version | Comments   |
|-----------------|--|
| 1               | Original   |
| 5               | Standard and most common   |
| 7               | Specific to Cisco Catalyst 6500 and 7600 Series Switches<br>Similar to Version 5, but does not include AS, interface, TCP Flag & TOS information     |
| 8               | Choice of eleven aggregation schemes<br>Reduces resource usage   |
| 9               | Flexible, extensible file export format to enable easier support of additional fields & technologies; coming out now MPLS, Multicast, & BGP Next Hop |

**Cisco Catalyst 6500 Series Router will support versions 5 & 8 in Cisco IOS Software Release 12.1(13)E**



# Version 5 - Flow Export Format



Version 5 used extensively today

# Version 8

- **Router-based aggregation**
- **Enables router to summarize NetFlow data**
- **Reduces NetFlow Export data volume**
- **Decreases NetFlow Export bandwidth requirements**
- **Currently 11 aggregation schemes**
  - **Five original schemes**
  - **Six new schemes with the TOS byte field**
- **Available in Cisco IOS Software Releases 12.0(15)S and 12.2(1)T**
- **Several aggregations can be enabled simultaneously**

# Why a New Version 9?

- **Fixed export formats are not flexible and adaptable**
- **With each new version Cisco creates new export fields**
- **Partners need to re-engineer for each new version**

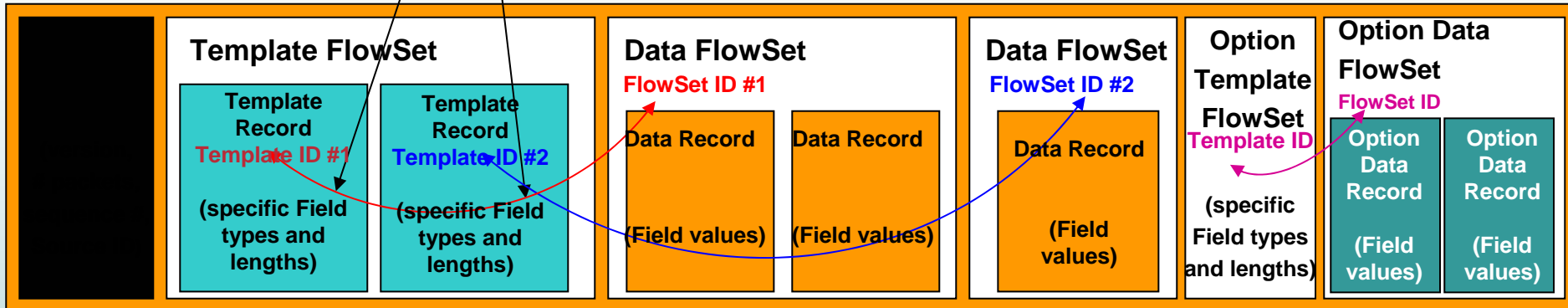
**Solution: Build a **flexible** and **extensible** export format called version 9!**

# NetFlow v9 Export Packet

To support technologies such as MPLS or Multicast, this export format can be leveraged to easily **insert new fields**

Flows from Interface A

Flows from Interface B



- Matching ID numbers are the way to associate template to the Data Records
- The Header follows the same format as prior NetFlow versions so Collectors will be backward compatible
- Each data record represents one flow
- If exported flows have the same fields, then they can be contained in the same Template Record (ie: unicast traffic) can be combined with multicast records
- If exported flows have different fields, then they cannot be contained in the same Template Record (ie: BGP next-hop cannot be combined with MPLS Aware NetFlow records)

# NetFlow v9 and IETF

- **Internet Protocol Flow Information eXport (IPFIX) is an IETF Working Group**

[ipfix.doit.wisc.edu/](http://ipfix.doit.wisc.edu/)

- **Netflow version 9 is the basis for the standard in the IETF**

- **Informational RFC on NetFlow version 9**

[www.ietf.org/internet-drafts/draft-bclaise-netflow-9-00.txt](http://www.ietf.org/internet-drafts/draft-bclaise-netflow-9-00.txt)



# NEW FEATURES



# NetFlow Version 9 Features

- **Multicast NetFlow version 9**
  - Availability: Major Release 12.3**
  - Ingress Accounting of replicated multicast packets**
  - Egress Per user accounting of multicast packets**
- **MPLS Aware NetFlow version 9**
  - Availability: Release 12.0(26)S**
  - Label and prefix export information**
- **BGP Next Hop version 9**
  - Availability: Releases 12.3 and 12.0(26)S**
  - Edge to Edge Traffic Matrix**
  - BGP traffic destination information**
- **NetFlow for IPv6**
  - Availability: Release 12.3(7)T**
  - Export IPv6 source and destination information**

# NetFlow Product Update

- **Sampled NetFlow**

**Availability: Releases 12.0(26)S, 12.3(2)T, and 12.2(18)S**

**Random Sampling of packets per flow with reduce CPU**

- **NetFlow MIB**

**Availability: Release 12.3(7)T**

**Top N Talker in MIB**

**NetFlow configuration using MIB**

- **Input Flow Filters**

**Availability: Release 12.3(7)T**

**QOS MQC based Filtering entering NetFlow**



# References

- **Cisco IOS NetFlow**

[www.cisco.com/go/netflow](http://www.cisco.com/go/netflow)

- **Cisco Network Accounting Services**

**Comparison of Cisco NetFlow versus other available accounting technologies**

[www.cisco.com/warp/public/cc/pd/iosw/prodlit/nwact\\_wp.htm](http://www.cisco.com/warp/public/cc/pd/iosw/prodlit/nwact_wp.htm)

# CISCO SYSTEMS

