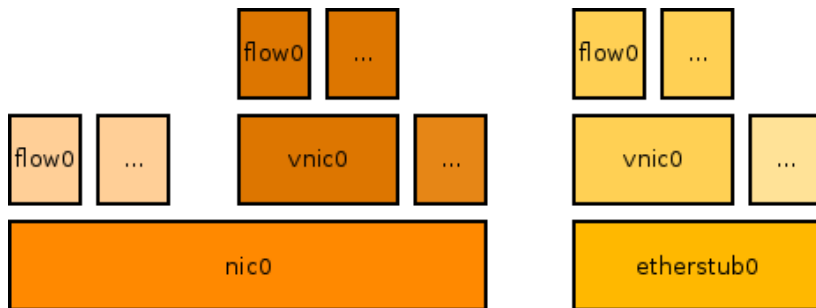


OpenSolaris, Crossbow and JIMS

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Crossbow components and their relationship



Available link operations

- ▶ Plumbing
- ▶ Putting interface up/down
- ▶ Setting IP address
- ▶ Setting address mask
- ▶ Getting parent link name

Etherstub and Link (Vnic, Nic) parameters

Read-only parameters:

- ▶ **BRIDGE** - The name of the bridge to which this link is assigned, if any
- ▶ **OVER** - The physical datalink(s) over which the datalink is operating
- ▶ **STATE** - The link state of the datalink. The state can be up, down, or unknown
- ▶ **MTU** - The maximum transmission unit size for the datalink being displayed
- ▶ **CLASS** - The class of the datalink. dladm distinguishes between the following classes:
 - ▶ **phys** - A physical datalink.
 - ▶ **vnic** - A virtual network interface.

Etherstub and Link (Vnic, Nic) properties

Editable properties:

- ▶ **maxbw** - The full duplex bandwidth specified as an integer with one of the scale suffixes (K, M, or G for Kbps, Mbps, and Gbps). The default is **no bandwidth limit**
- ▶ **learn_limit** - Limits the number of new or changed MAC sources to be learned over a bridge link. The default is **1000**
- ▶ **cpus** - Names of processors that can perform operations for this link. The default is **no CPU binding**
- ▶ **priority** - Relative priority for the link. Possible values are: **high**, **medium**, or **low**. The default is **high**

Etherstub and Link (Vnic, Nic) statistics

Read-only statistics:

- ▶ **IPACKETS** - Number of packets received on this link
- ▶ **RBYTES** - Number of bytes received on this link
- ▶ **IERRORS** - Number of input errors
- ▶ **OPACKETS** - Number of packets sent on this link
- ▶ **OBYTES** - Number of bytes sent on this link
- ▶ **OERRORS** - Number of output errors

Flows

Bandwidth control and priority for protocols, services and containers.

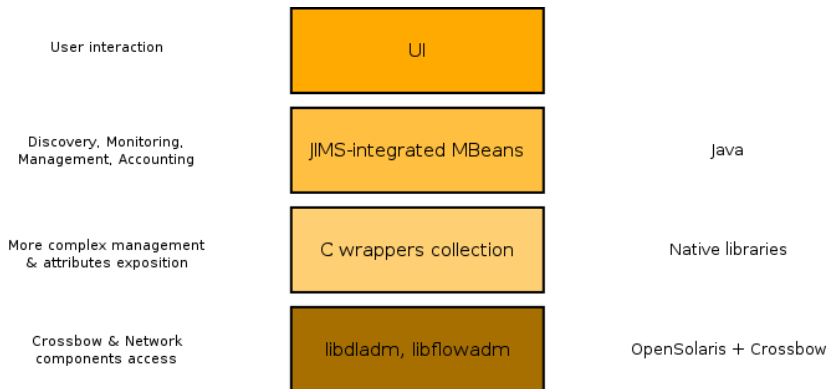
Individual flow restrictions:

- ▶ **local_port, remote_port**
- ▶ **transport - tcp|udp|sctp|icmp|icmpv6**
- ▶ **dsfield**
- ▶ **local_ip[/prefix_len], remote_ip[/prefix_len]**

Flow restrictions:

- ▶ **maxbw** - The full duplex bandwidth.
- ▶ **priority** - Relative priority for the flow.

Layers and responsibility



lib*adm

Crossbow Project libraries.

- ▶ libdladm provides API to manipulate VNICs, etherstubs and NICs
- ▶ libflowadm allows flow management (descriptors - e.g. addresses, protocols, ports, QoS - flow priority and maximum bandwidth)

Simple operations: `dladm_set_flowprop`, `dladm_vnic_delete`, etc.

Native wrappers

Exploit Crossbow lower-level *adm libraries to provide more complex functionality.

3 modules: `xbow-native-lib-etherstub`,
`xbow-native-lib-flow`, `xbow-native-lib-link`.

- ▶ `create_etherstub`
- ▶ `get_properties`
- ▶ `plumb`

MBeans

Two kinds of objects:

- ▶ managers (EterstubManager, FlowManager, (V)NicManager)
entity discovery, creation, deletion
- ▶ entities (flows, etherstubs, V(NIC)s)
 - ▶ per-instance attributes management and monitoring
 - ▶ hierarchy reflected in naming (e.g. MBean for flow0 created over e1000g0 link is registered as
`<domain>:type=Flow,link=e1000g0,name=flow0`)

Most often 1:1 MBean method : Native function mapping with
return code to exception translation.

Graphic User Interface

Possible frameworks:

- ▶ Eclipse RCP
- ▶ Jopr
- ▶ Web frameworks (Spring 3, JSP)

Roadmap

- ▶ DONE
C wrappers, MBeans layer → management and monitoring possible with JConsole
- ▶ ONGOING
JIMS integration, collecting statistics
- ▶ FUTURE
Graphic user Interface, QoS-aware zone migration

Development and code quality

- ▶ Java and native builds with maven
- ▶ Unit tests & mocks for both MBean and native code
- ▶ Code coverage reports