Broverview

Bro Workshop 2011
NCSA, Urbana-Champaign, IL

Outline

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Philosophy and Architecture

A *framework* for network traffic analysis.

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A *framework* for network traffic analysis.

History

From research to operations.

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Philosophy and Architecture

A *framework* for network traffic analysis.

History

From research to operations.

Architecture

Components, logs, scripts, cluster.

What is Bro?

What is Bro?

Packet Capture

What is Bro?

Packet Capture

Traffic Inspection

What is Bro?

Packet Capture

Traffic Inspection

Attack Detection

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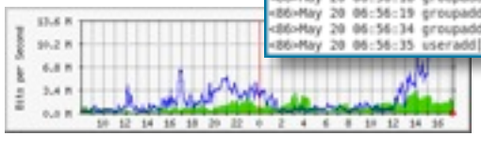
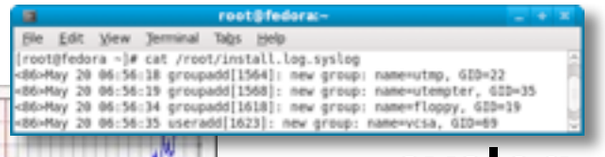
Attack Detection

NetFlow





syslog

Log Recording

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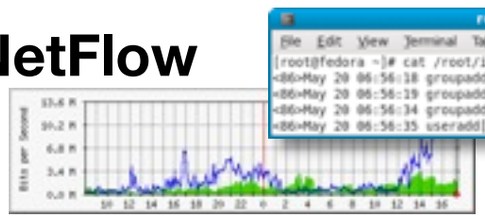

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Flexibility
Abstraction
Data Structures

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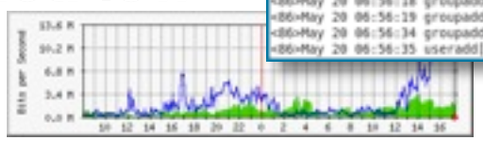

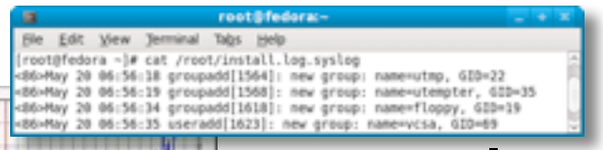

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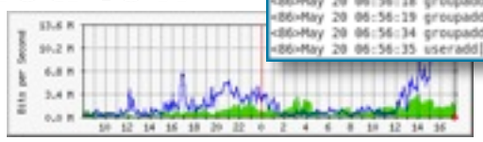

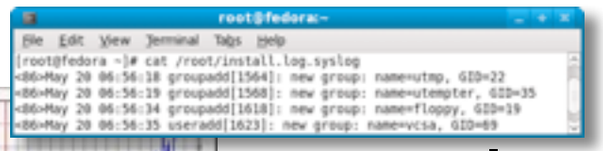

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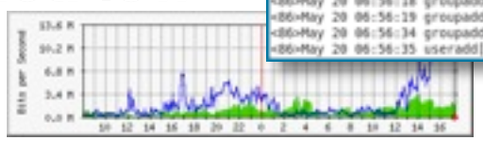

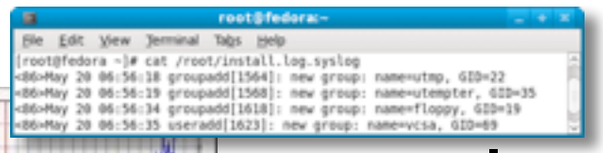

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"Domain-specific Python"

NCSA

What is Bro?

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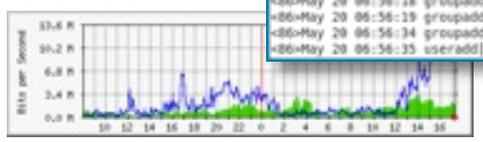
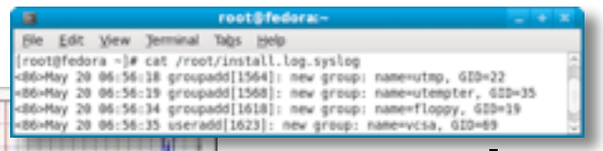
Sum is more than the pieces

"Domain-specific Python"

NetFlow





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Fundamentally different from other IDS.

Reset your idea of an IDS before starting to use Bro.

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Policy-neutral at the core.

Can accommodate a range of detection approaches.

Highly stateful.

Tracks extensive application-layer network state.

Supports forensics.

Extensively logs what it sees.

Target Audience

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Large-scale environments.

Effective also with liberal security policies.

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Network-savvy users.

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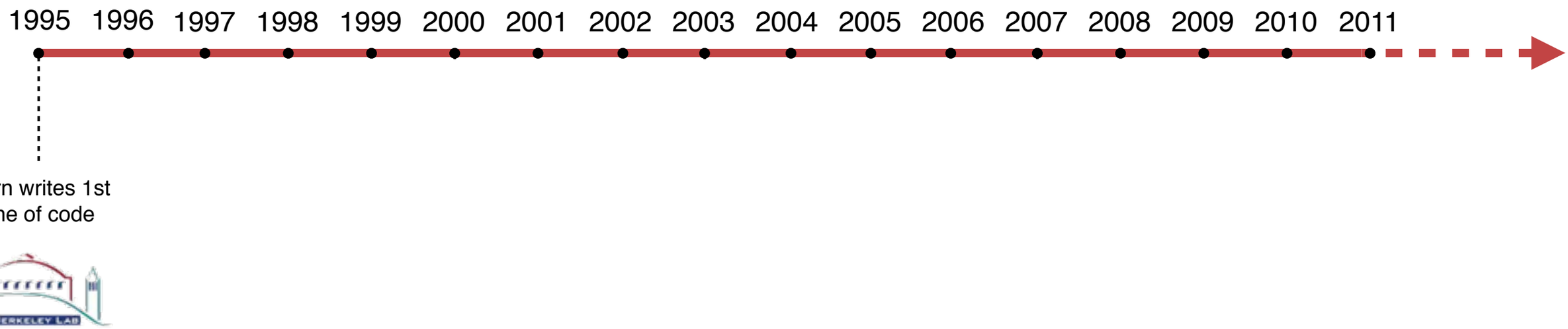
Unixy mindset.

Command-line based, fully customizable.

Bro History


1995
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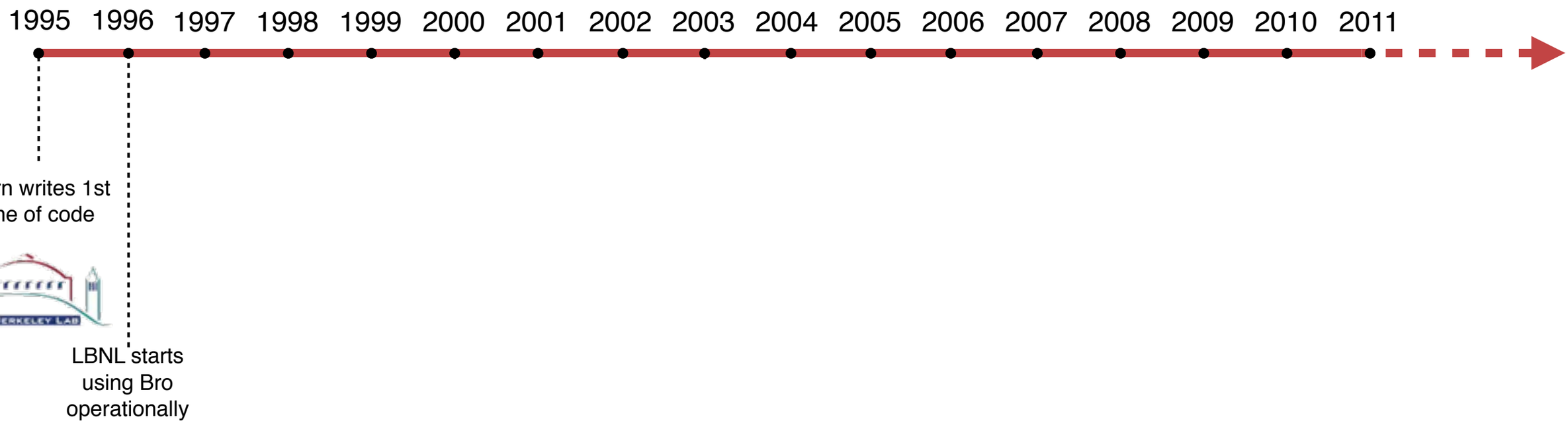
Vern writes 1st line of code

Bro History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v0.2
1st CHANGES entry

v0.4
HTTP analysis
Scan detector
IP fragments
Linux support

v0.6
RegExps
Login analysis

v0.7a48
Consistent CHANGES

v0.7a90
Profiling
State Mgmt

v0.7a175/0.8aX
Signatures
SMTP
IPv6 support
User manual

0.8a37
Communication
Persistence
Namespaces
Log Rotation

v0.8aX/0.9aX
SSL/SMB
STABLE releases
BroLite

v1.0
BinPAC
IRC/RPC analyzers
64-bit support
Sane version numbers

v1.1/v1.2
when Stmt
Resource tuning
Broccoli
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Ctor expressions
GeoIP
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NetFlow
Bro Lite Deprecated

v1.5
BroControl

Bro Waters

Bro 2.0

Bro History

Academic Publications

1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011

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USENIX Paper

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NSF now funding Bro *development* at ICSI and NCSA.

Full-time engineers working 3 years on capabilities & user experience.

Office of Cyberinfrastructure

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Objective is a sustainable development model.

Aiming to create a larger user and development community.

Office of Cyberinfrastructure

Deployment

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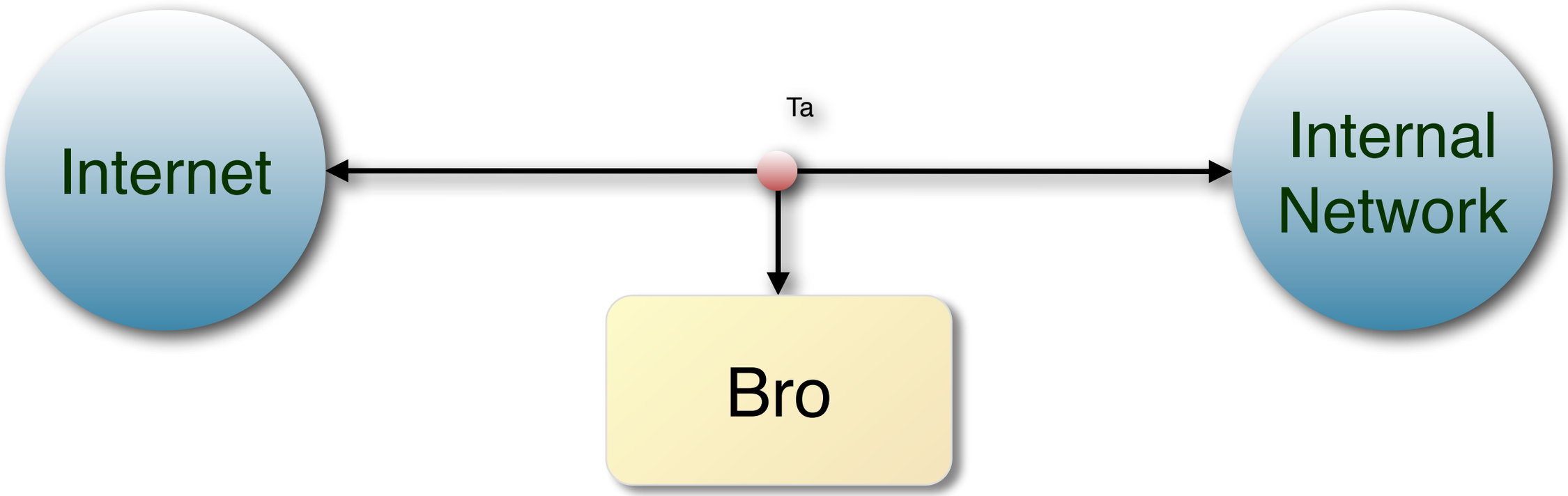
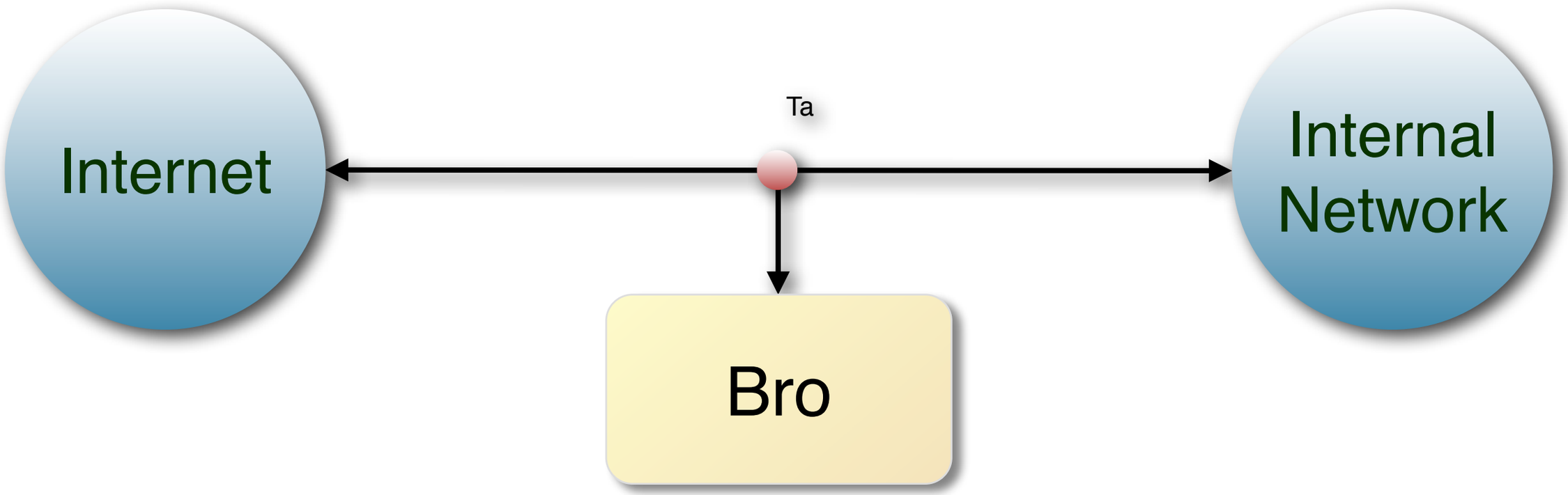


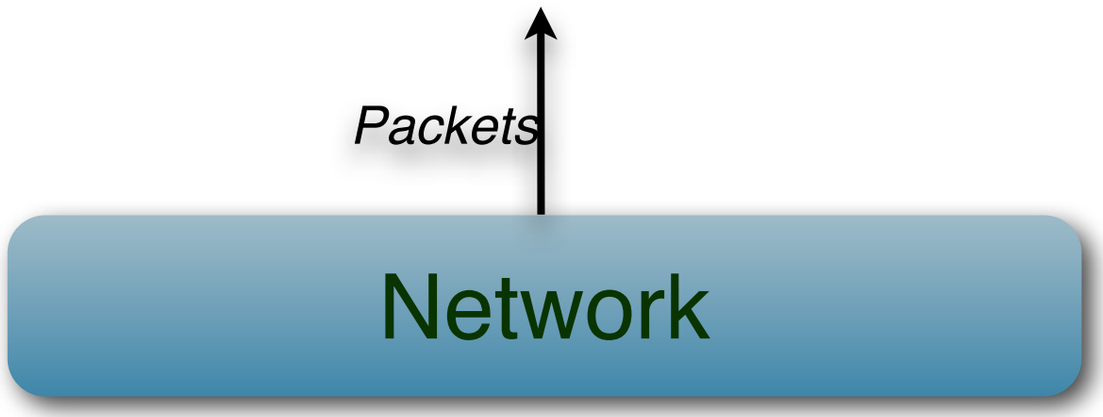
Deployment



Runs on commodity platforms.

- Standard PCs & NICs.
- Supports FreeBSD/Linux/OS X.

Architecture



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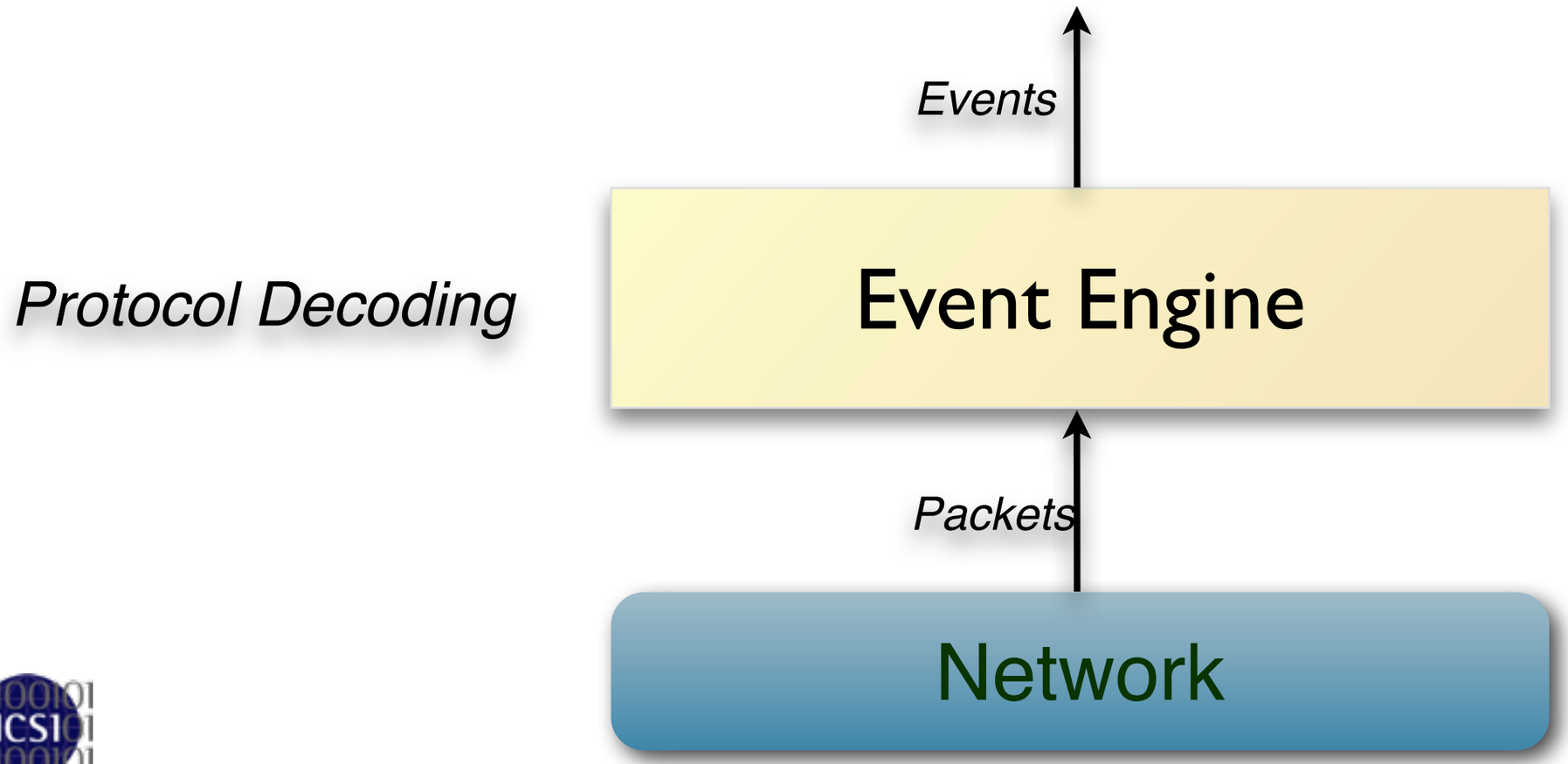
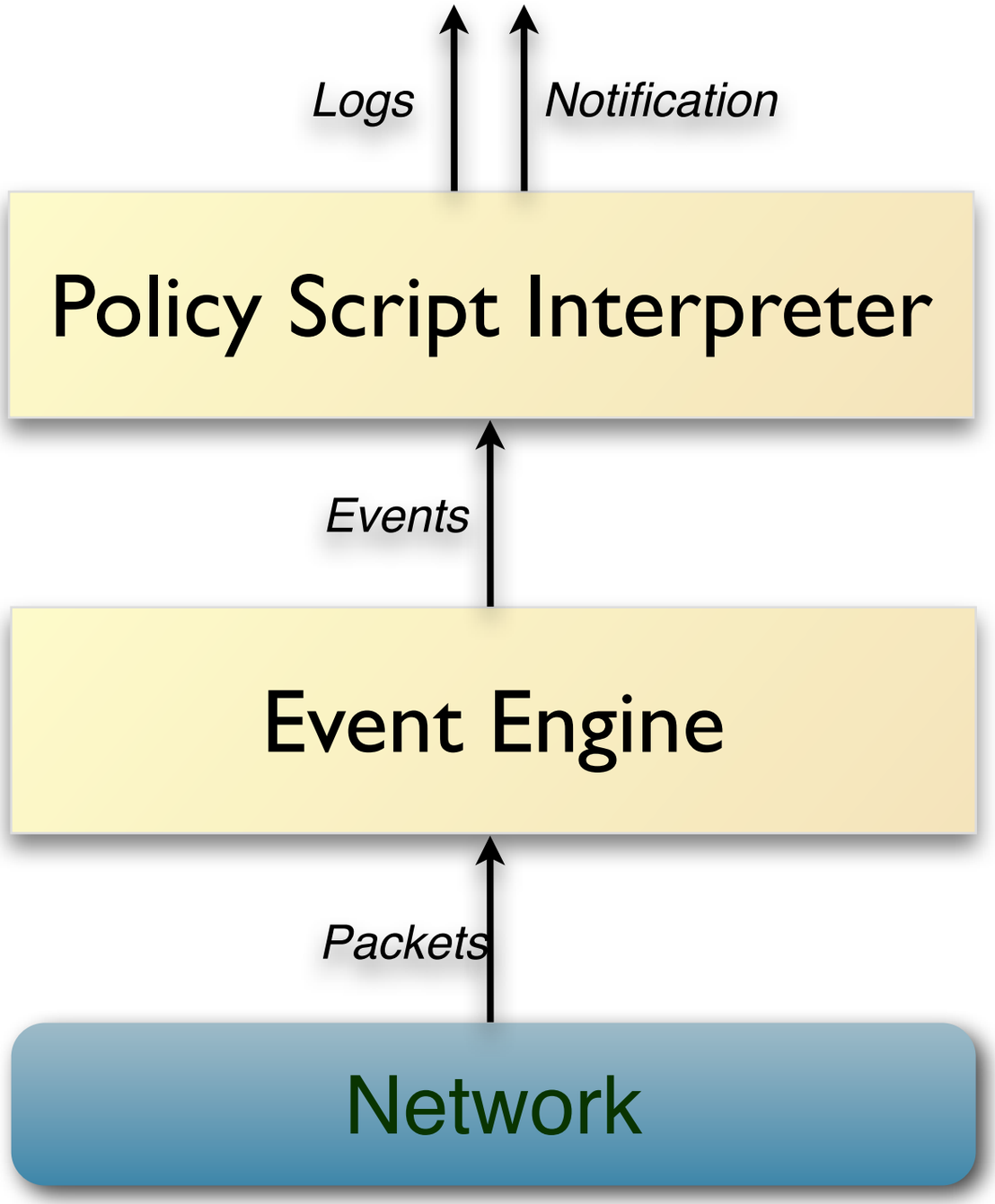


Architecture

Analysis Logic

Protocol Decoding



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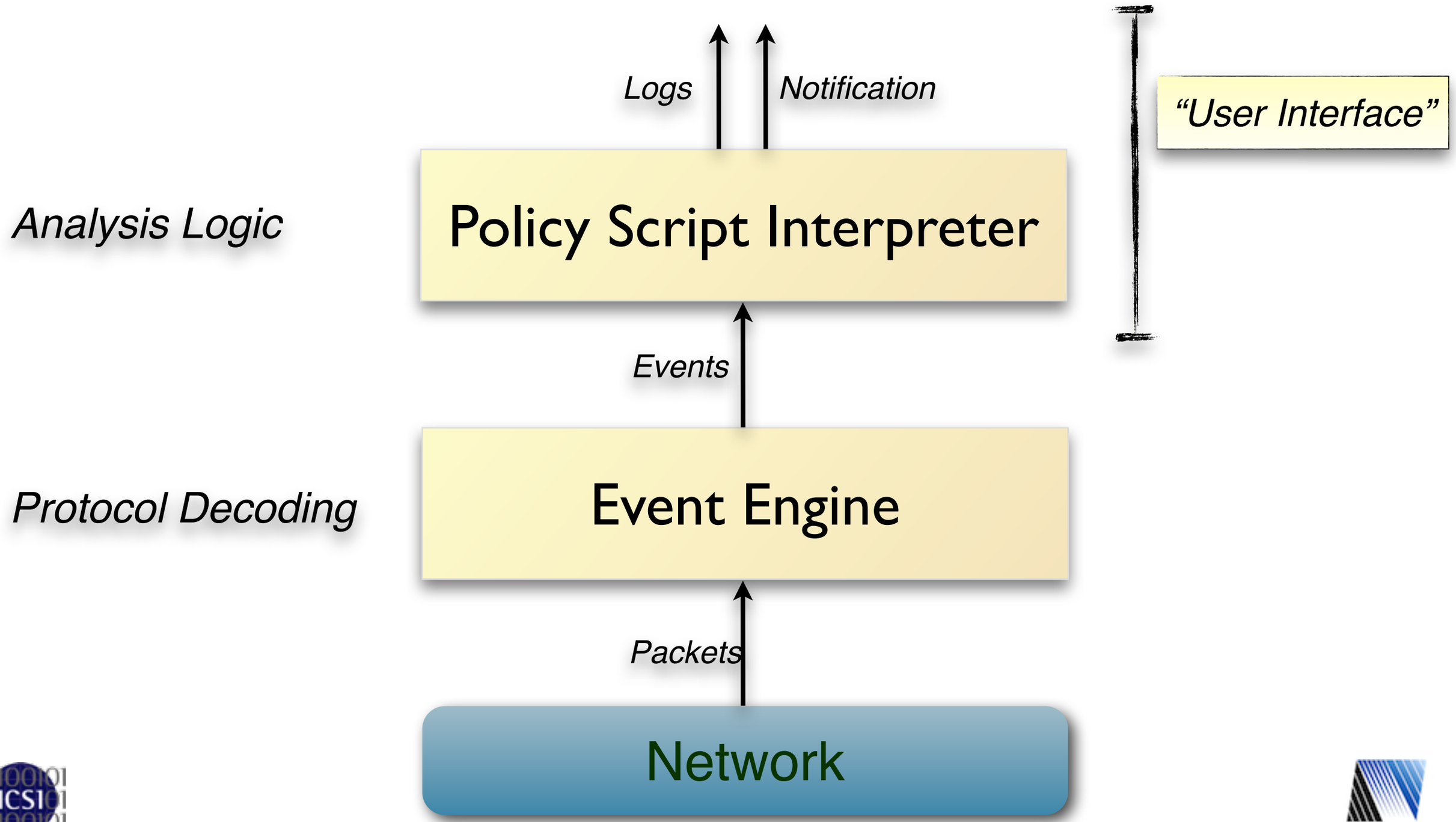

Script Example: Matching URLs

Task: Report all Web requests for files called "`passwd`".

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```
event http_request(c: connection,           # Connection.
                   method: string,          # HTTP method.
                   original_URI: string,    # Requested URL.
                   unescaped_URI: string,   # Decoded URL.
                   version: string)         # HTTP version.
{
    if ( method == "GET" && unescaped_URI == /.*passwd/ )
        NOTICE(...); # Alarm.
}
```

Script Example: Scan Detector

Task: Count failed connection attempts per source address.

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```
global attempts: table[addr] of count &default=0;

event connection_rejected(c: connection)
{
        local source = c$id$orig_h;      # Get source address.
        local n = ++attempts[source];    # Increase counter.
        if ( n == SOME_THRESHOLD )       # Check for threshold.
            NOTICE(...);                 # Alarm.
}
```

Distributed Scripts

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Bro comes with >10,000 lines of script code.

Prewritten functionality that's just loaded.

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Prewritten functionality that's just loaded.

Scripts generate alarms and logs.

Amendable to extensive customization and extension.

Example Logs

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> bro -i en0
[ ... wait ...]
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#fields ts	*id.orig_h*	*id.orig_p*	*id.resp_h*	*id.resp_p*	*proto*	*service*	*duration*	*obytes*	*rbytes* [...]
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1144876612.6063	192.150.186.169	53090	198.189.255.82	80	tcp	http	4.437460	8661	63663
1144876596.5597	192.150.186.169	53051	193.203.227.129	80	tcp	http	0.372440	461	753
1144876606.7789	192.150.186.169	53082	198.189.255.73	80	tcp	http	0.597711	337	5146
1144876741.4693	**192.150.186.169**	**53116**	**82.94.237.218**	**80**	**tcp**	**http**	**16.02667**	**3027**	**11761**
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1144876741.6335	192.150.186.169	53116	docs.python.org	/lib/lib.css	200	Mozilla/5.0
1144876742.1687	192.150.186.169	53116	docs.python.org	/icons/previous.png	304	Mozilla/5.0
1144876741.2838	192.150.186.169	53115	docs.python.org	/lib/lib.html	200	Mozilla/5.0
1144876742.3337	192.150.186.169	53116	docs.python.org	/icons/up.png	304	Mozilla/5.0
1144876742.3337	192.150.186.169	53116	docs.python.org	/icons/next.png	304	Mozilla/5.0
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1144876742.3337	192.150.186.169	53116	docs.python.org	/icons/modules.png	304	Mozilla/5.0
1144876742.3338	192.150.186.169	53116	docs.python.org	/icons/index.png	304	Mozilla/5.0
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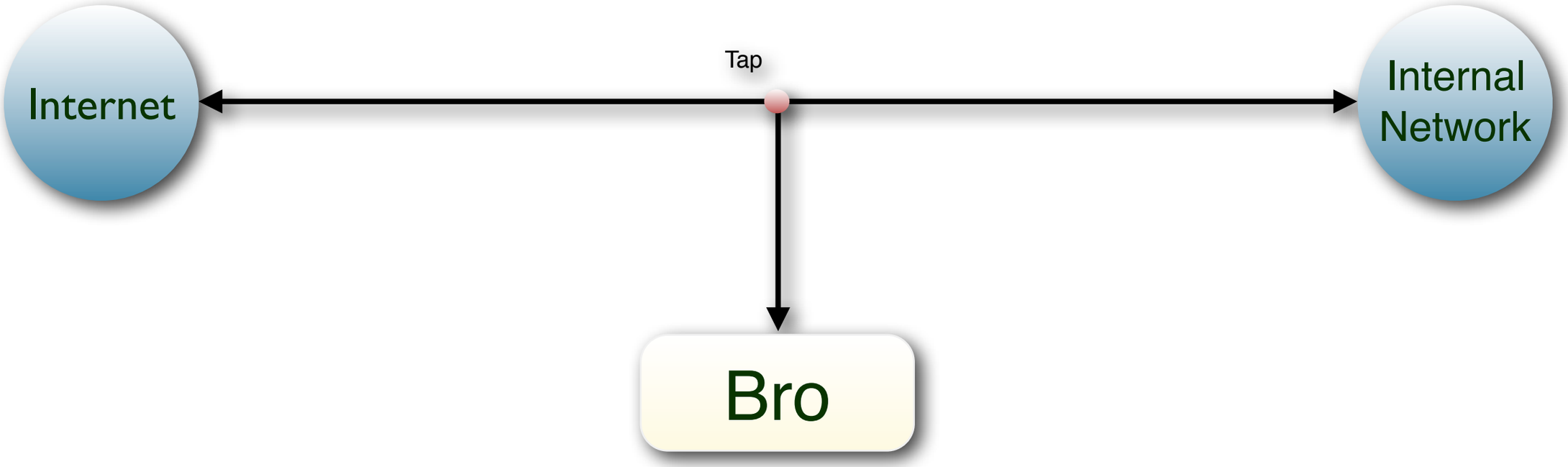
Bro Ecosystem



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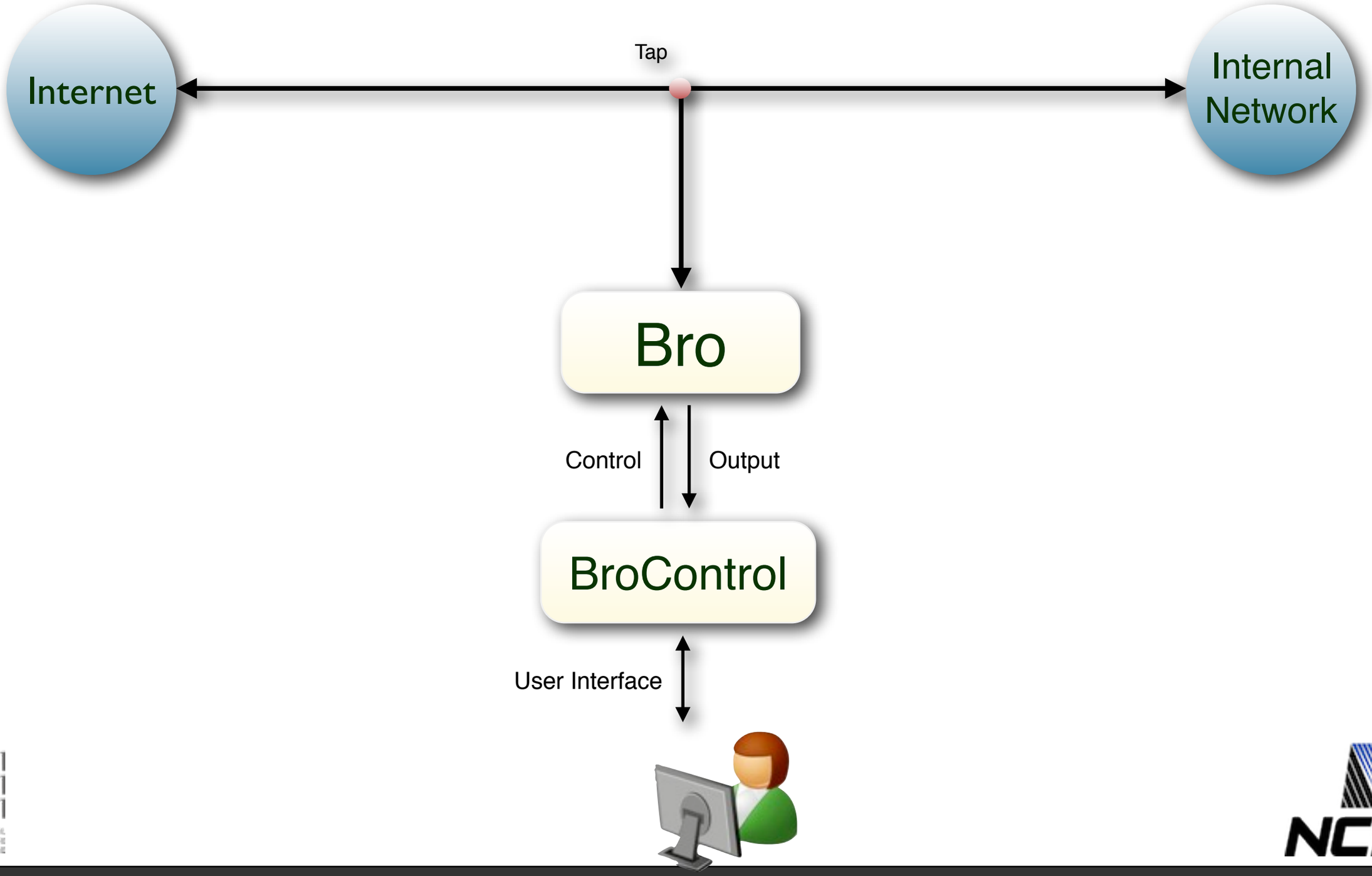

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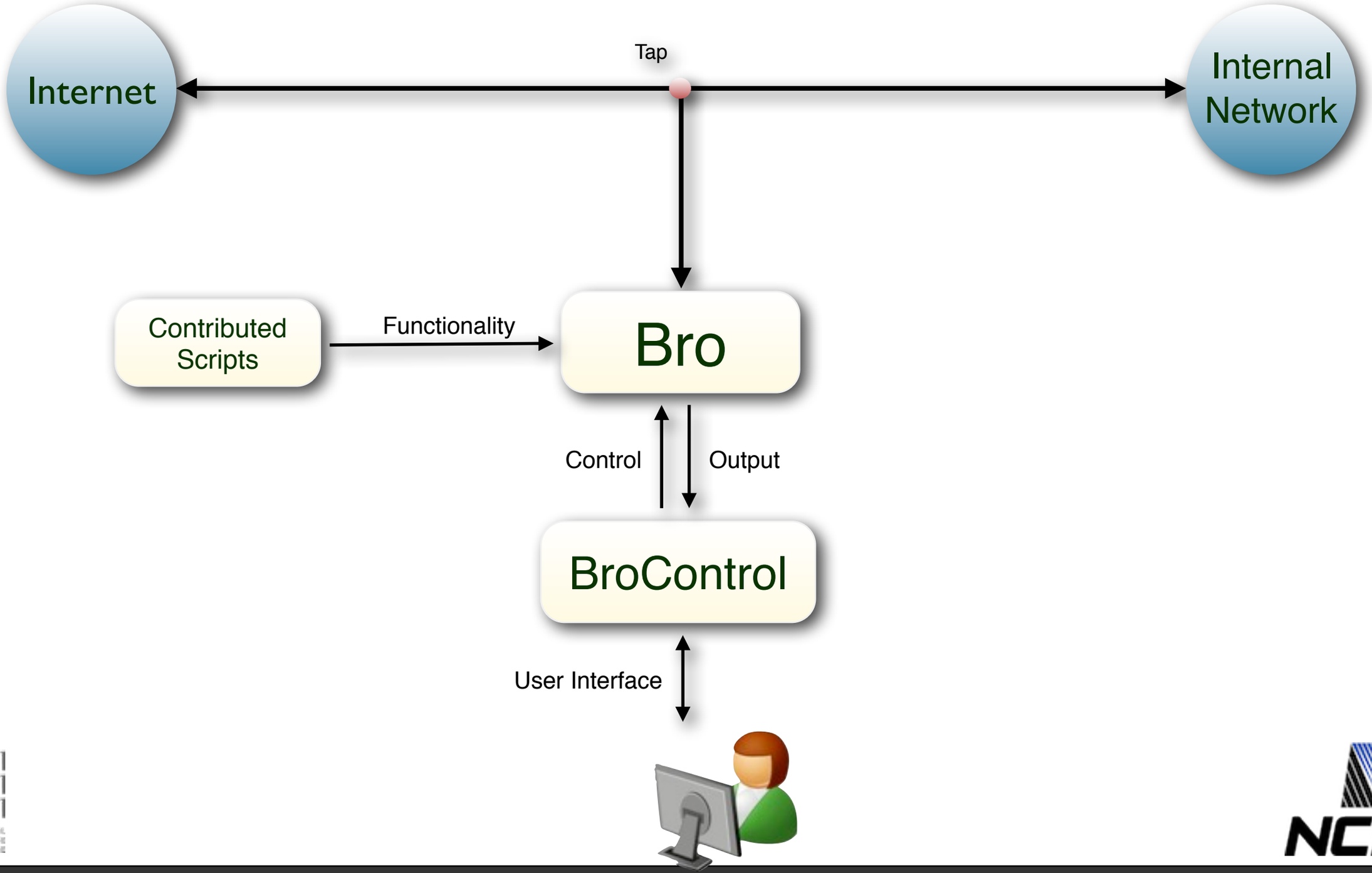

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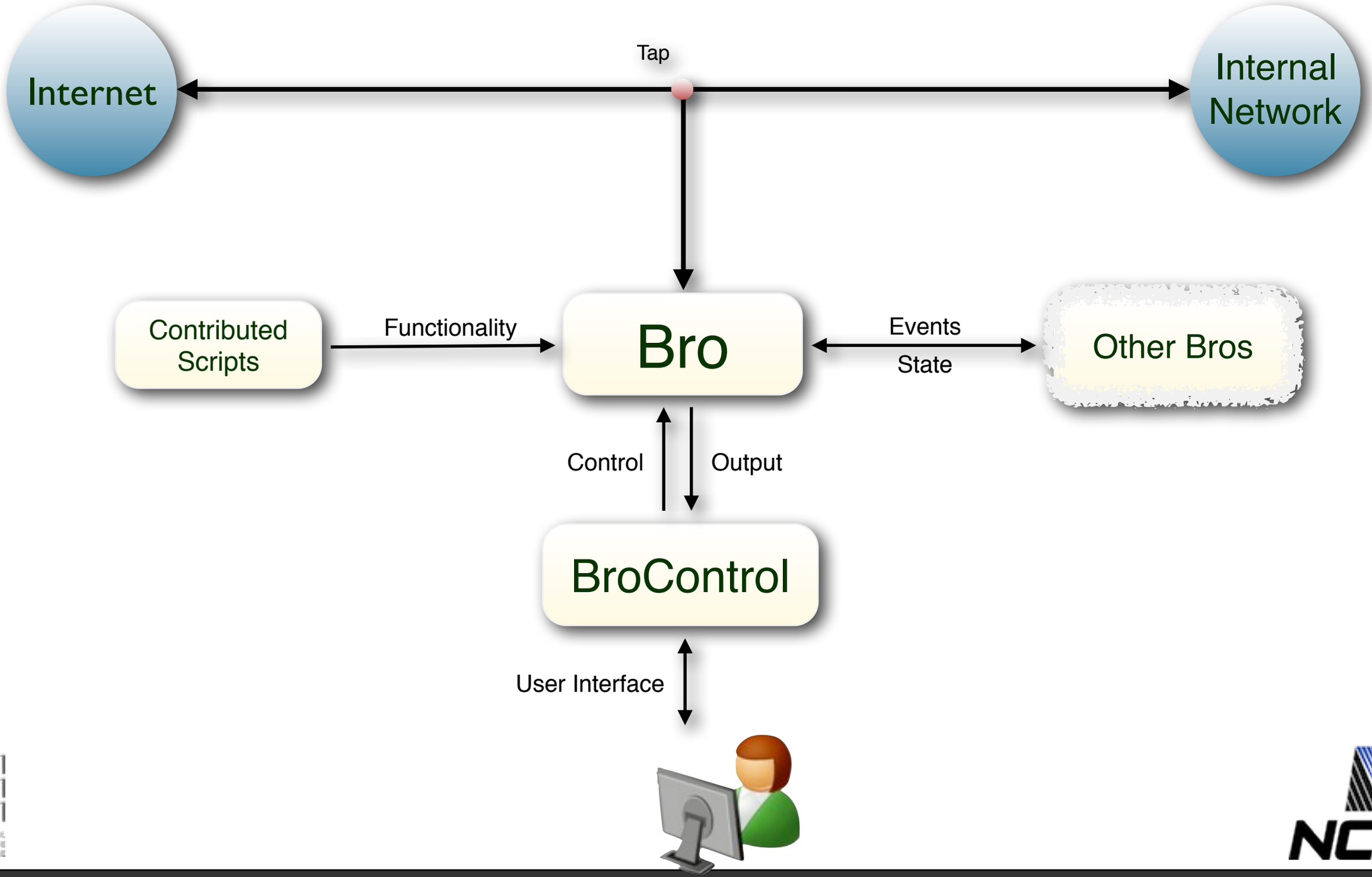

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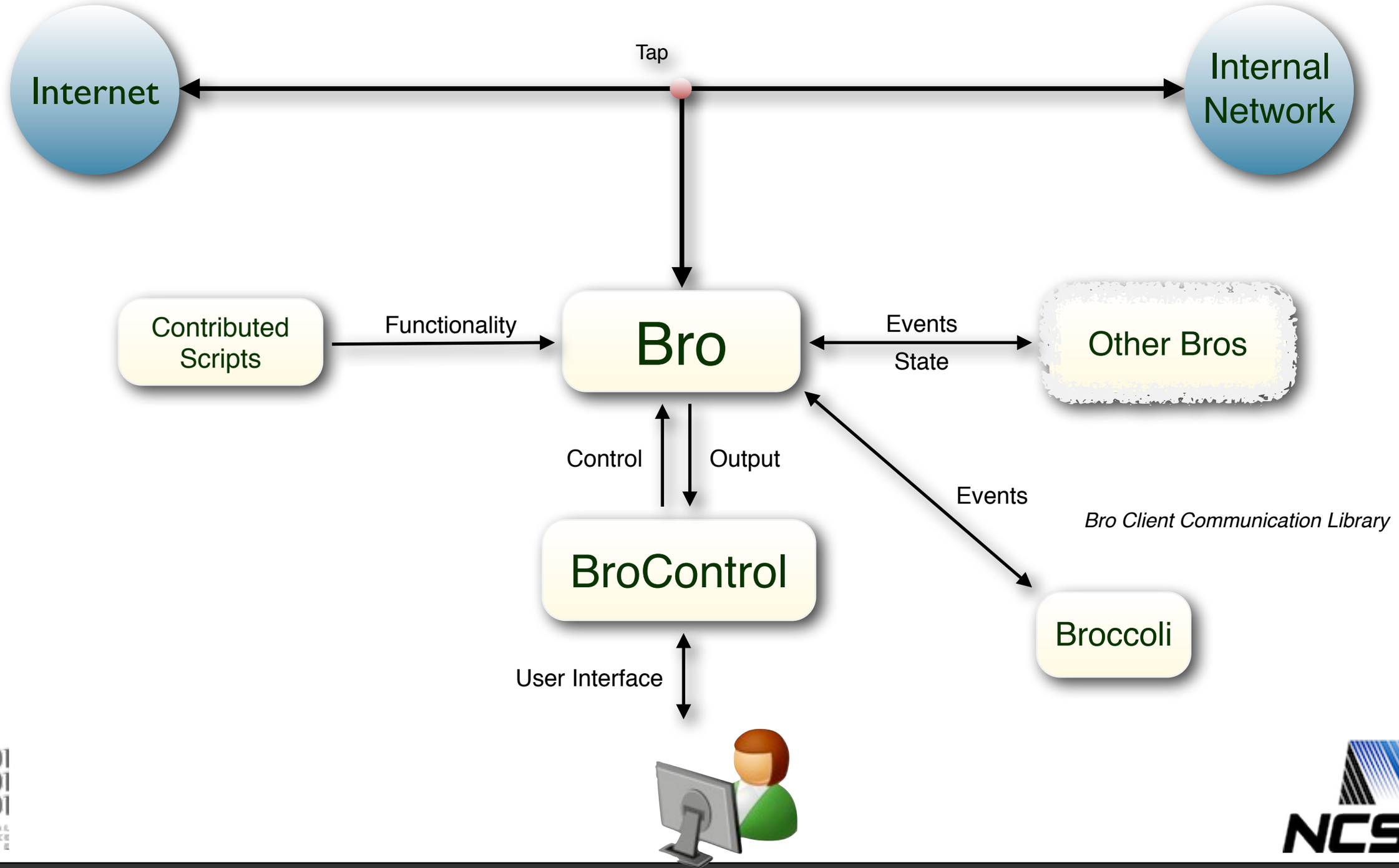

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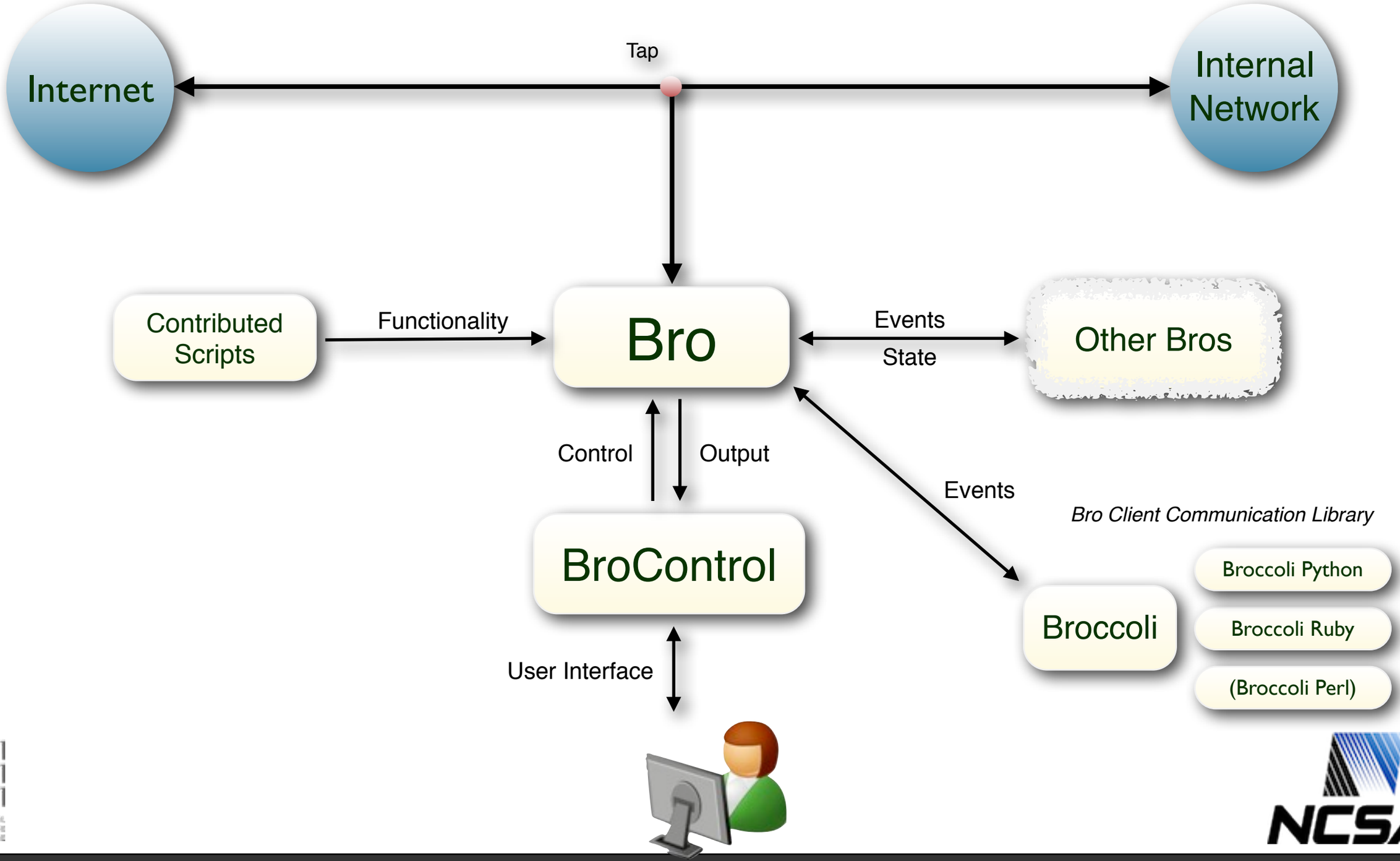

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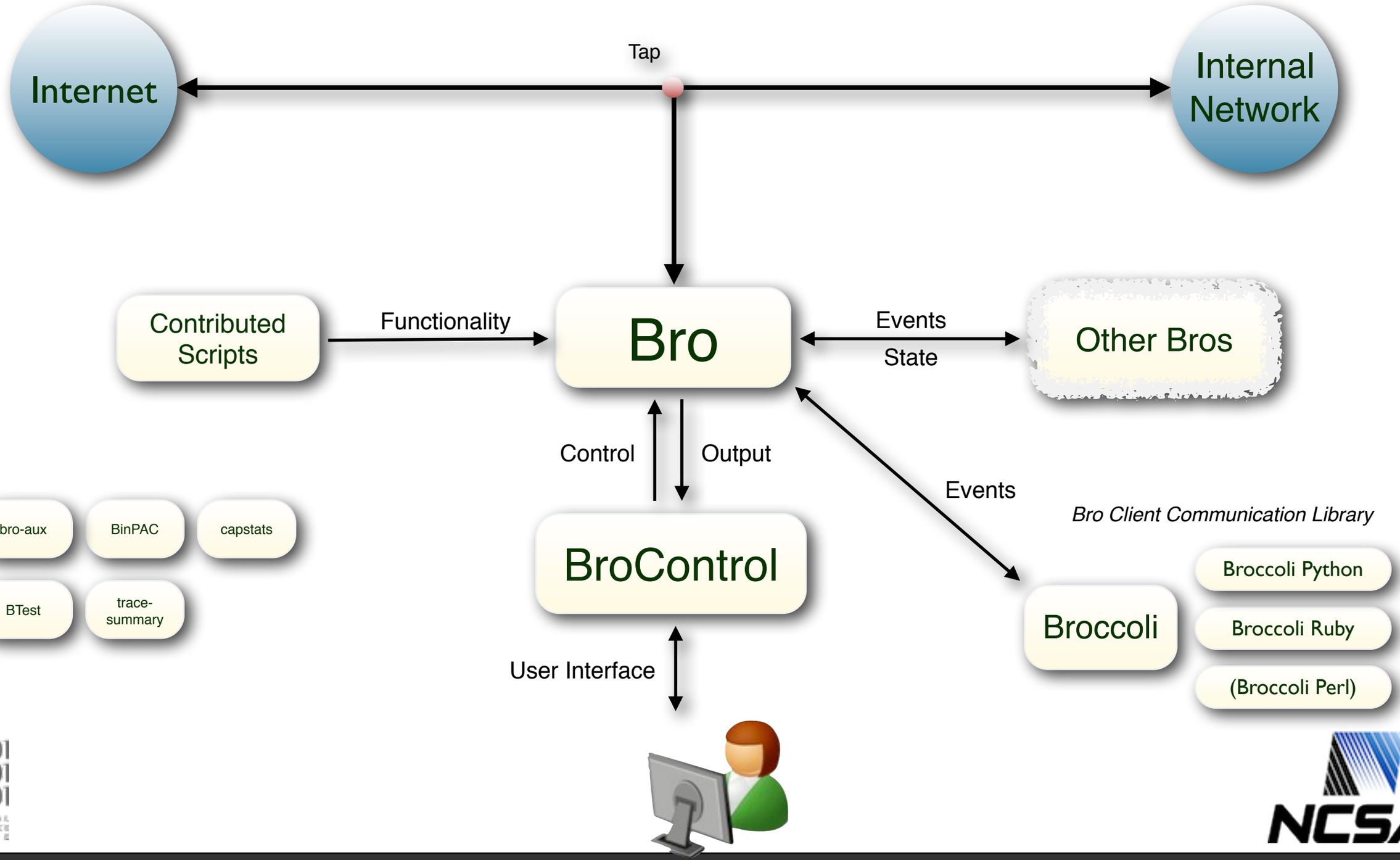
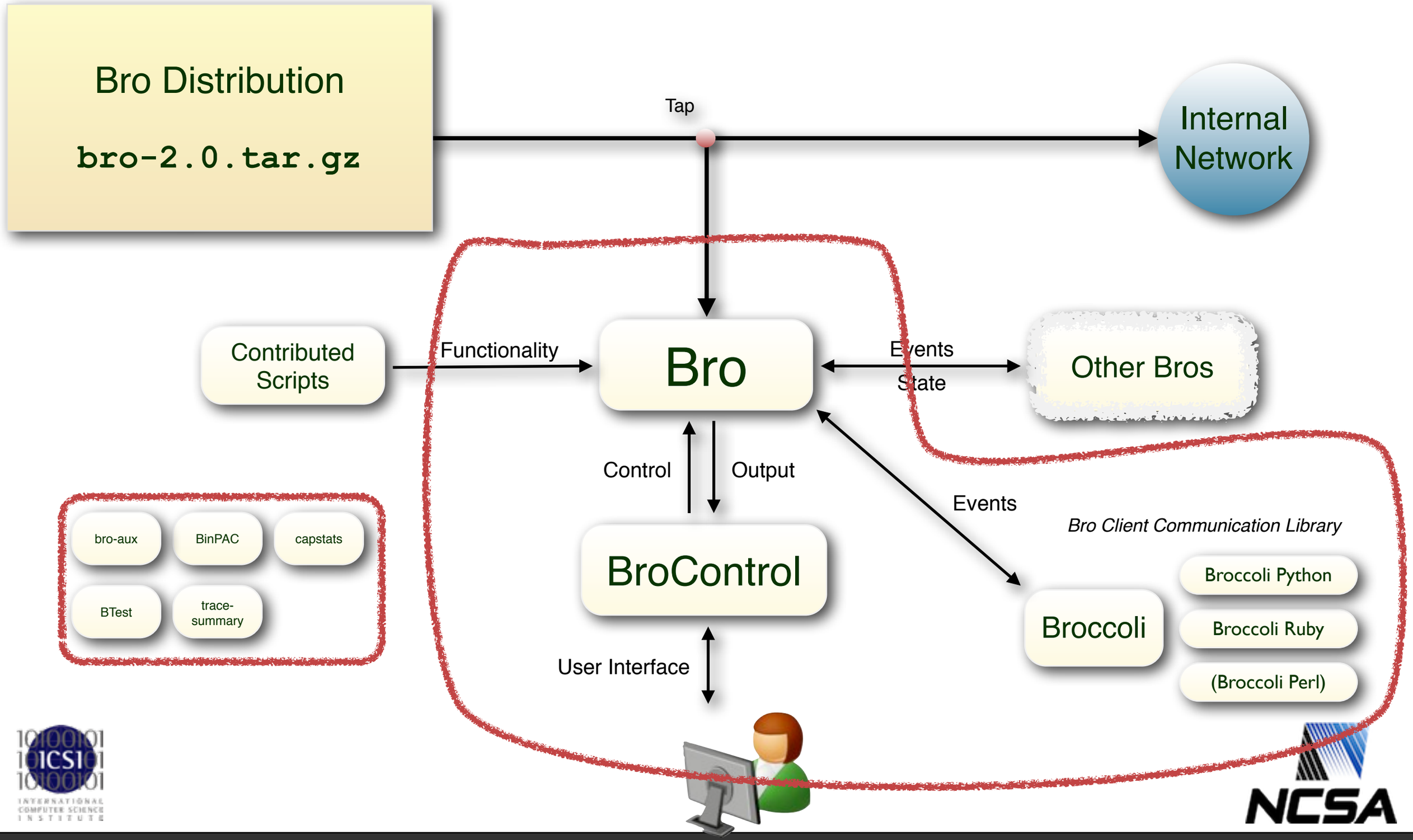


Bro Ecosystem

Bro Distribution

`bro-2.0.tar.gz`



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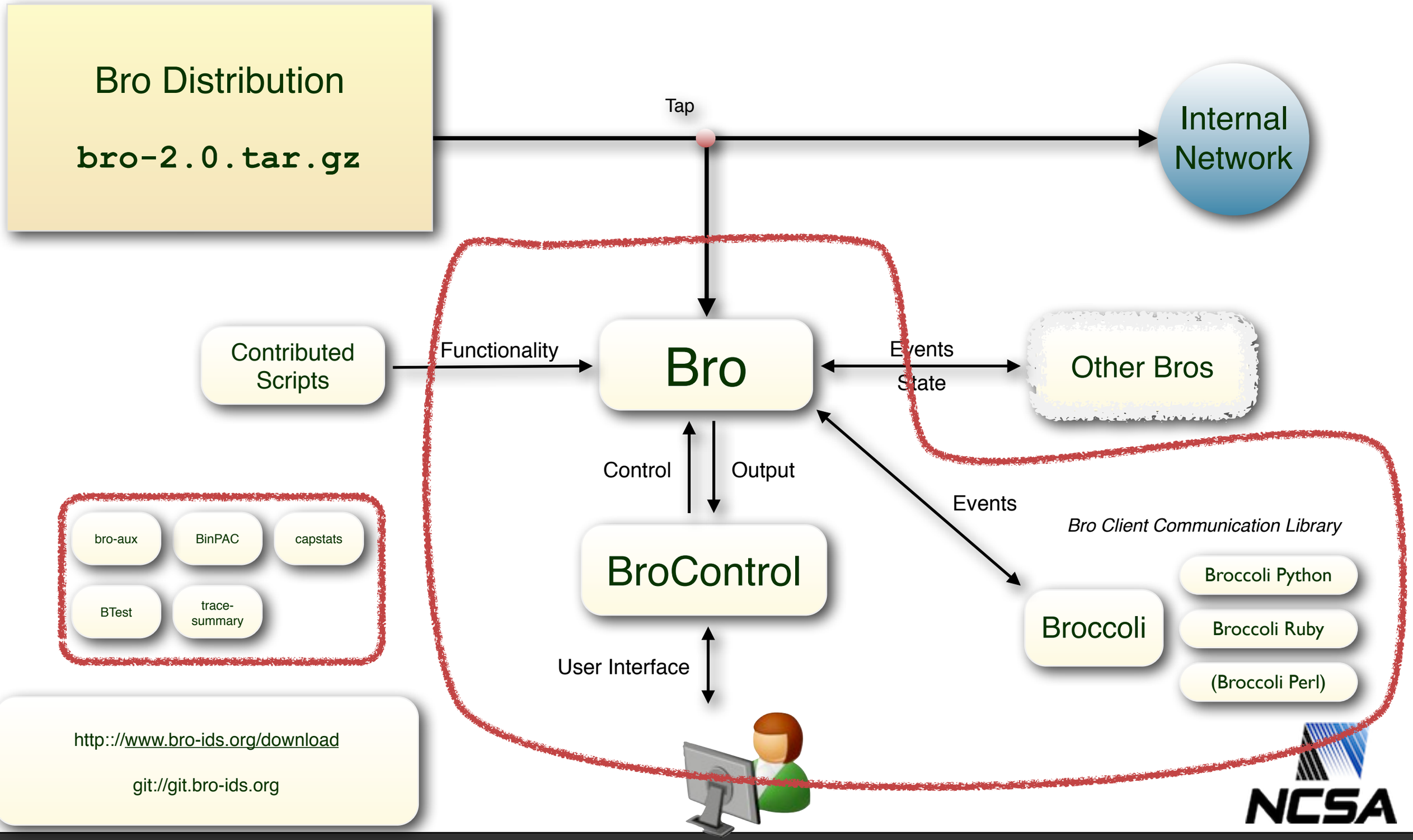
Bro Distribution

`bro-2.0.tar.gz`

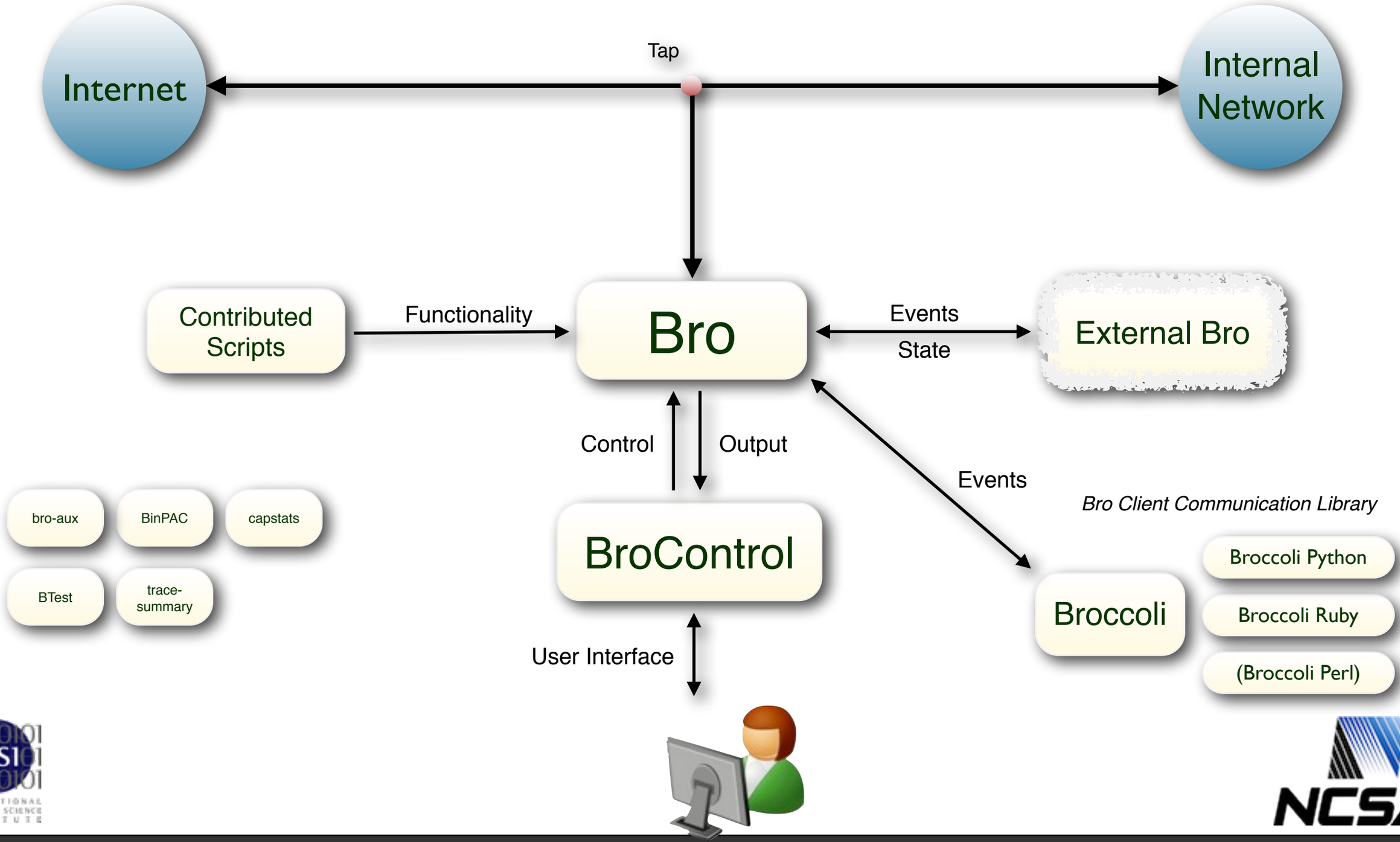


http:://www.bro-ids.org/download

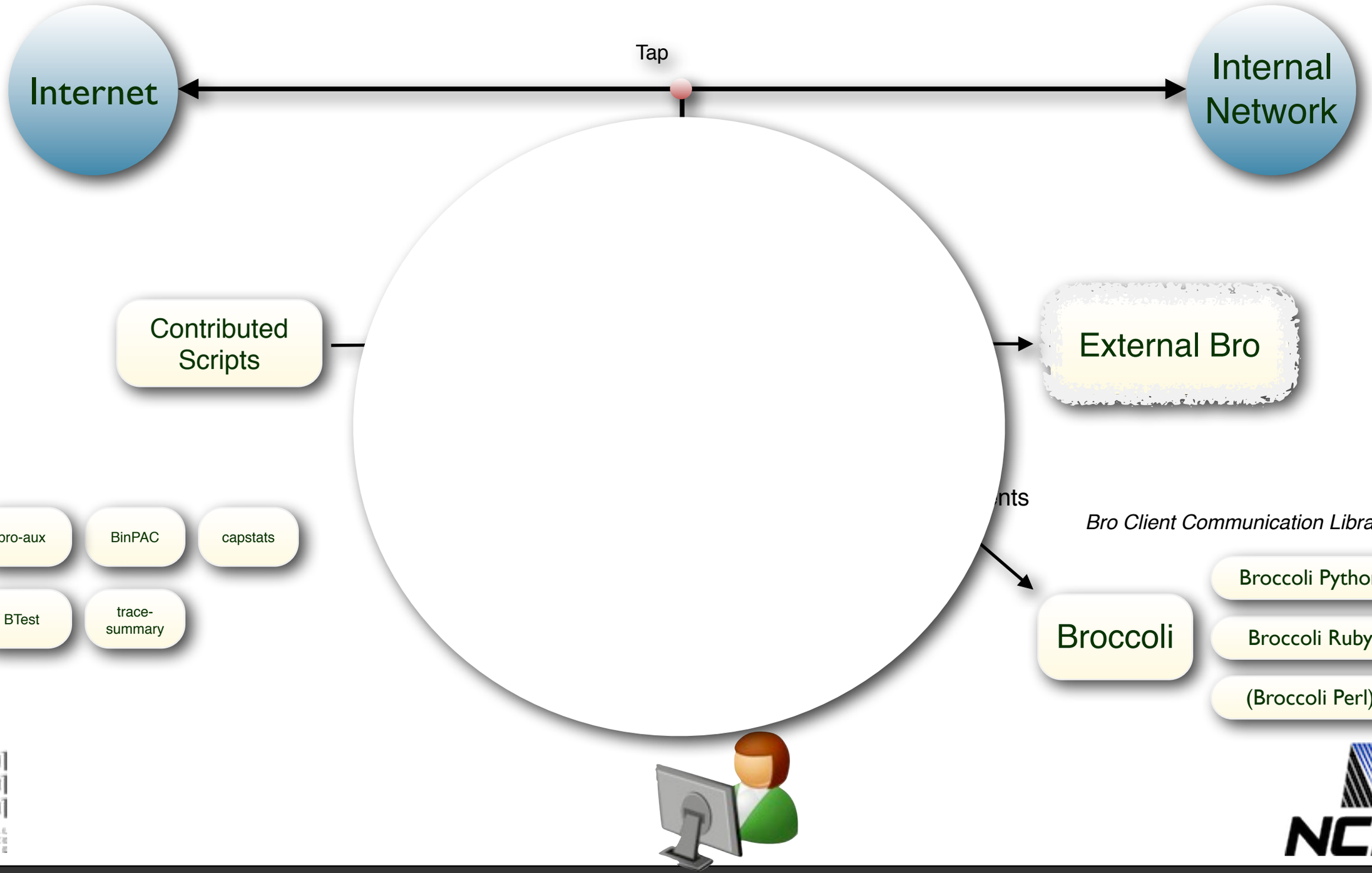
git://git.bro-ids.org

NCSA

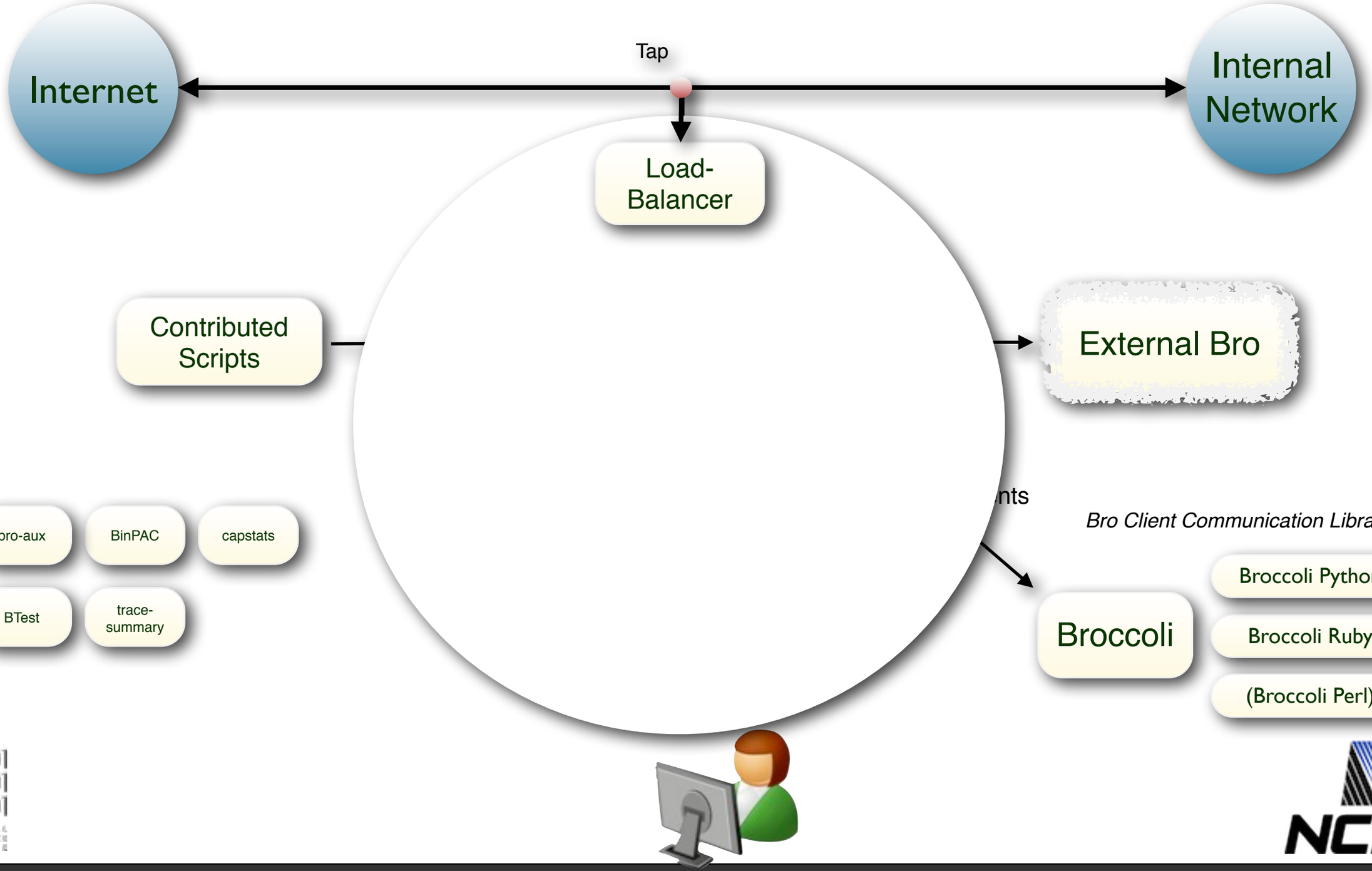
Bro *Cluster* Ecosystem



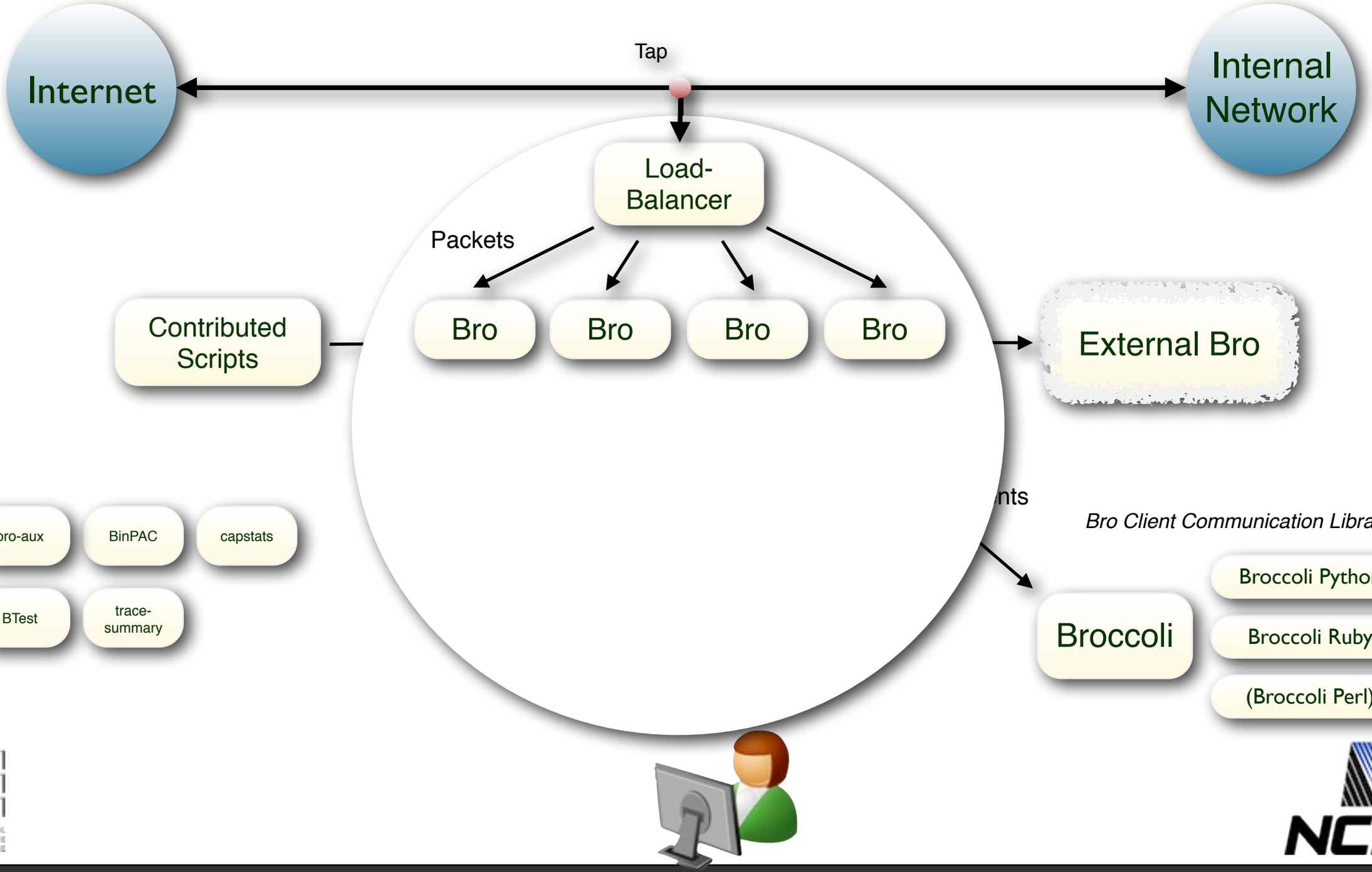
Bro *Cluster* Ecosystem



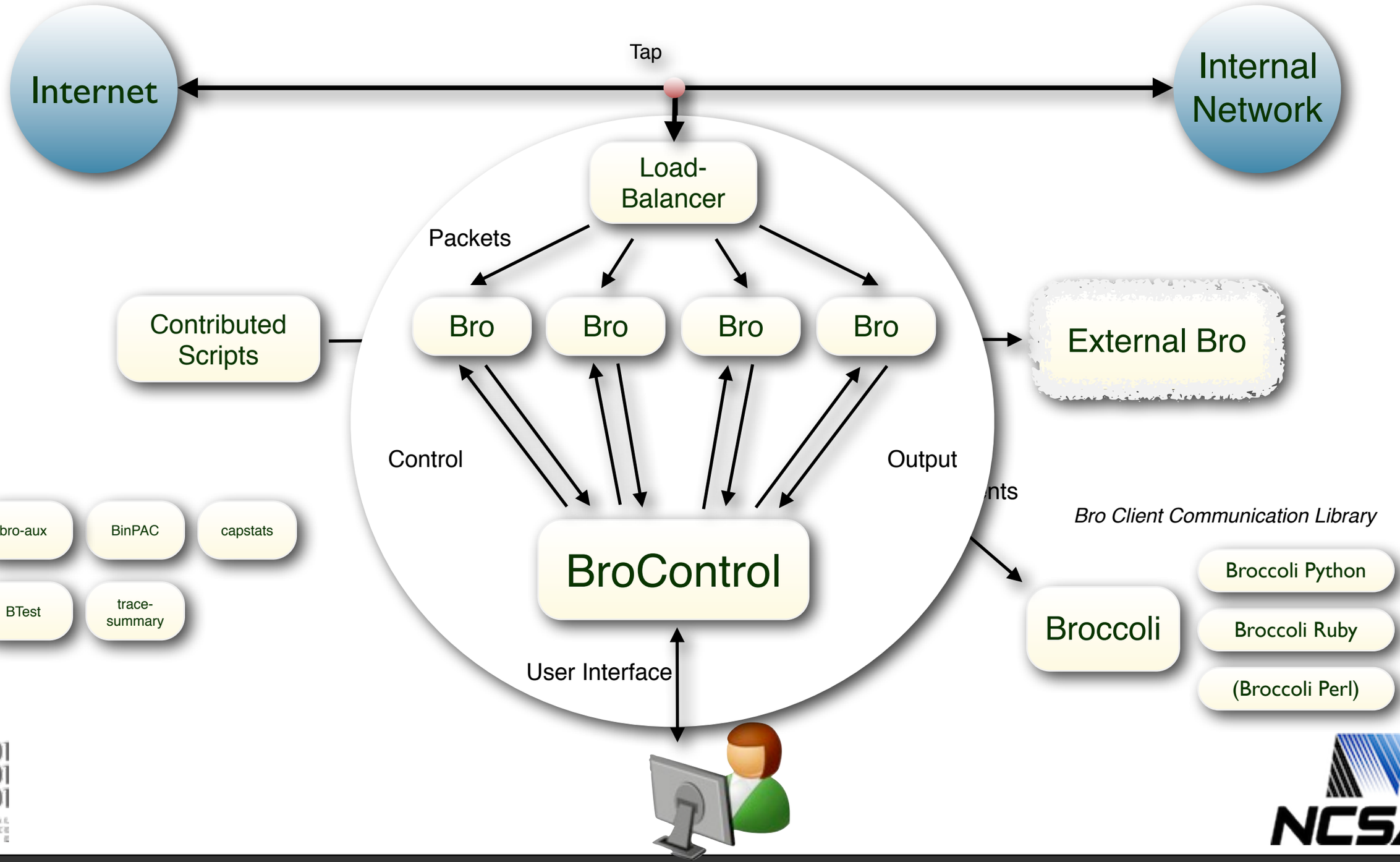
Bro *Cluster* Ecosystem



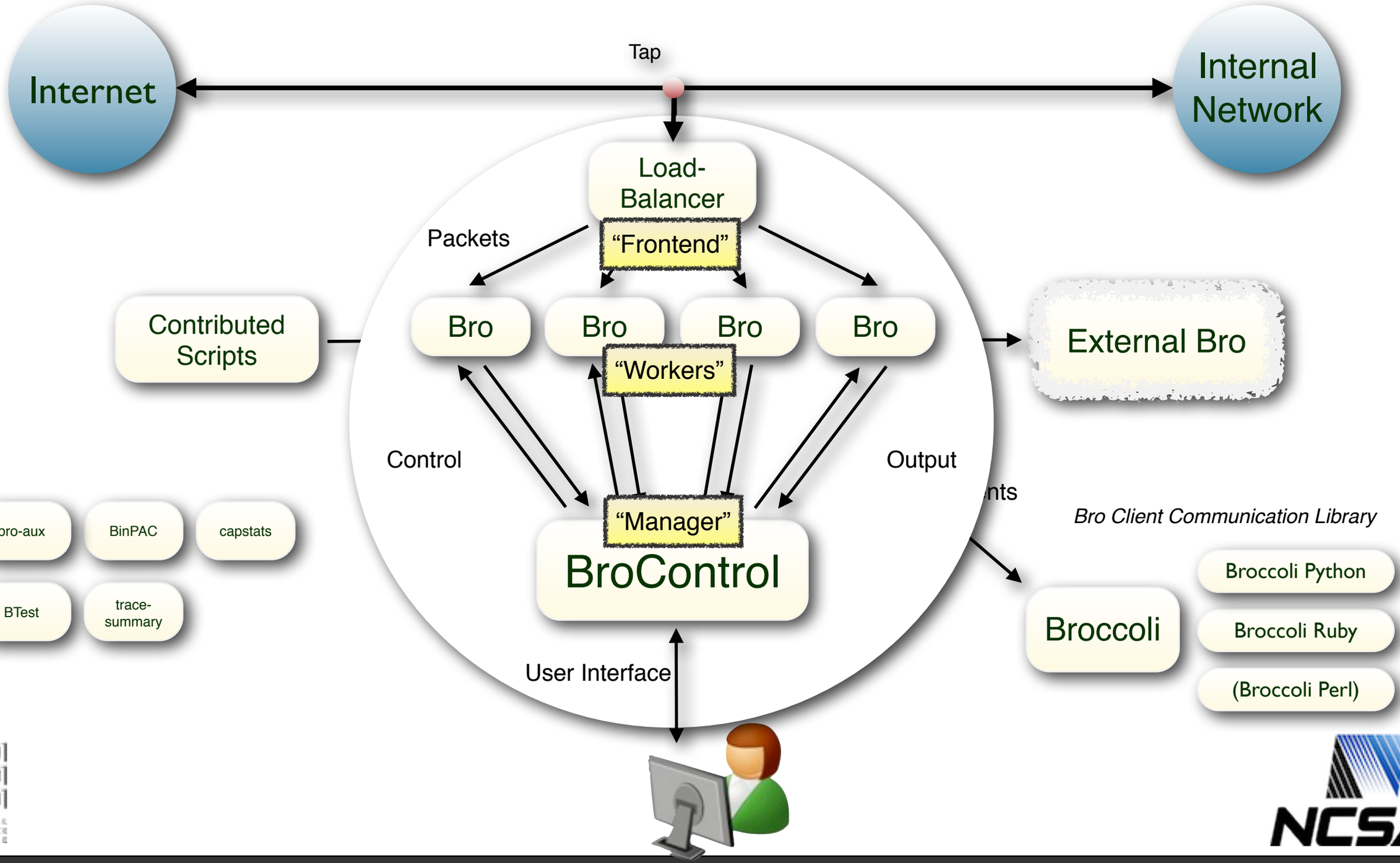
Bro *Cluster* Ecosystem



Bro *Cluster* Ecosystem



Bro *Cluster* Ecosystem

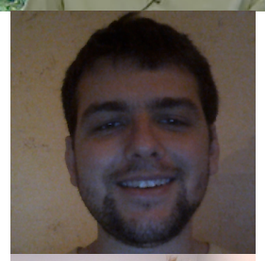


"The Bro Team"

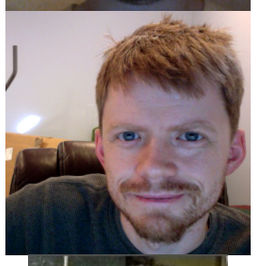
Vern Paxson

Jim Barlow

Gilbert Clark



Seth Hall

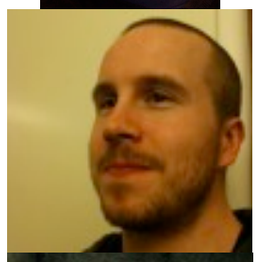


Christian Kreibich

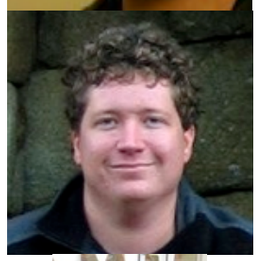
Hui Lin

Gregor Maier

Jonathan Siwek



Adam Slagell



Robin Sommer

Daniel Thayer

Matthias Vallentin