University of Amsterdam
System and Network Engineering

Improving the Performance of IPOP
Research Project 2

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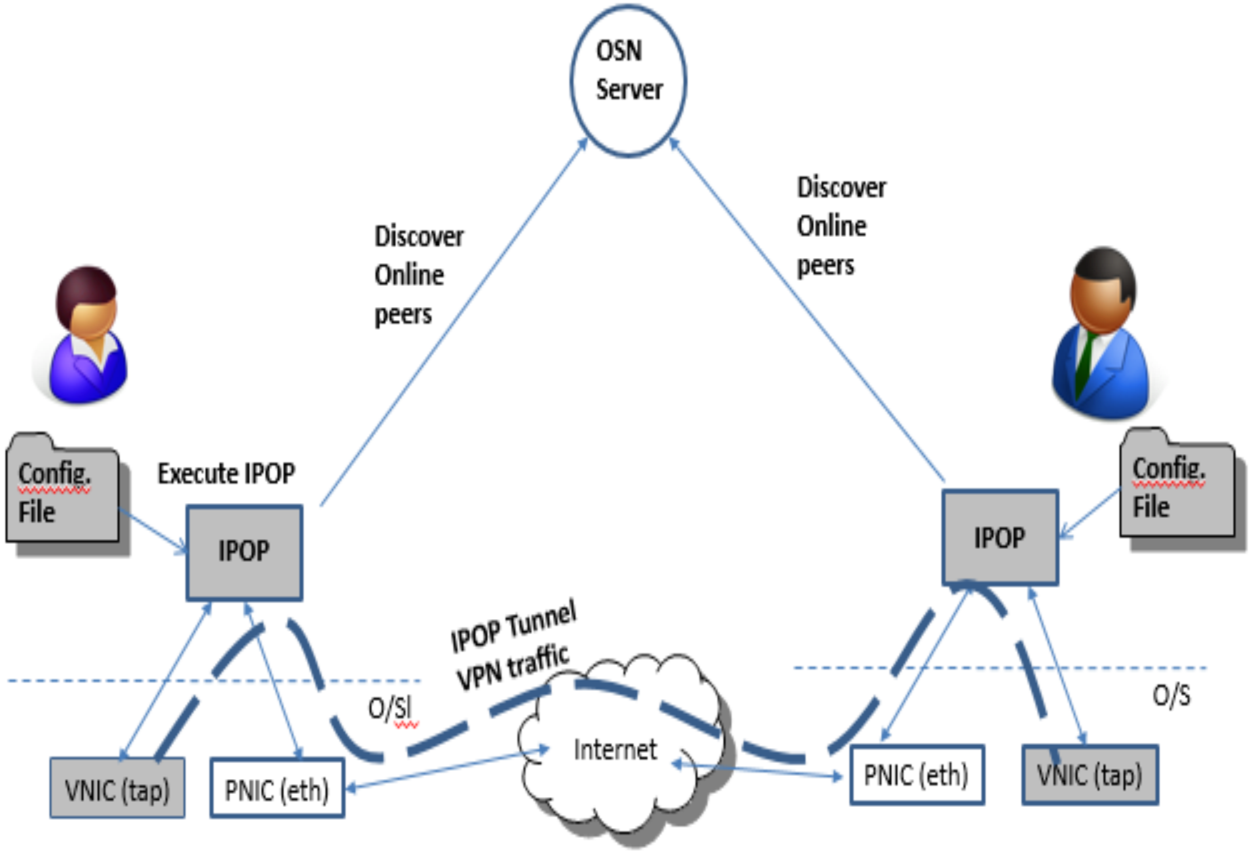
IPOP

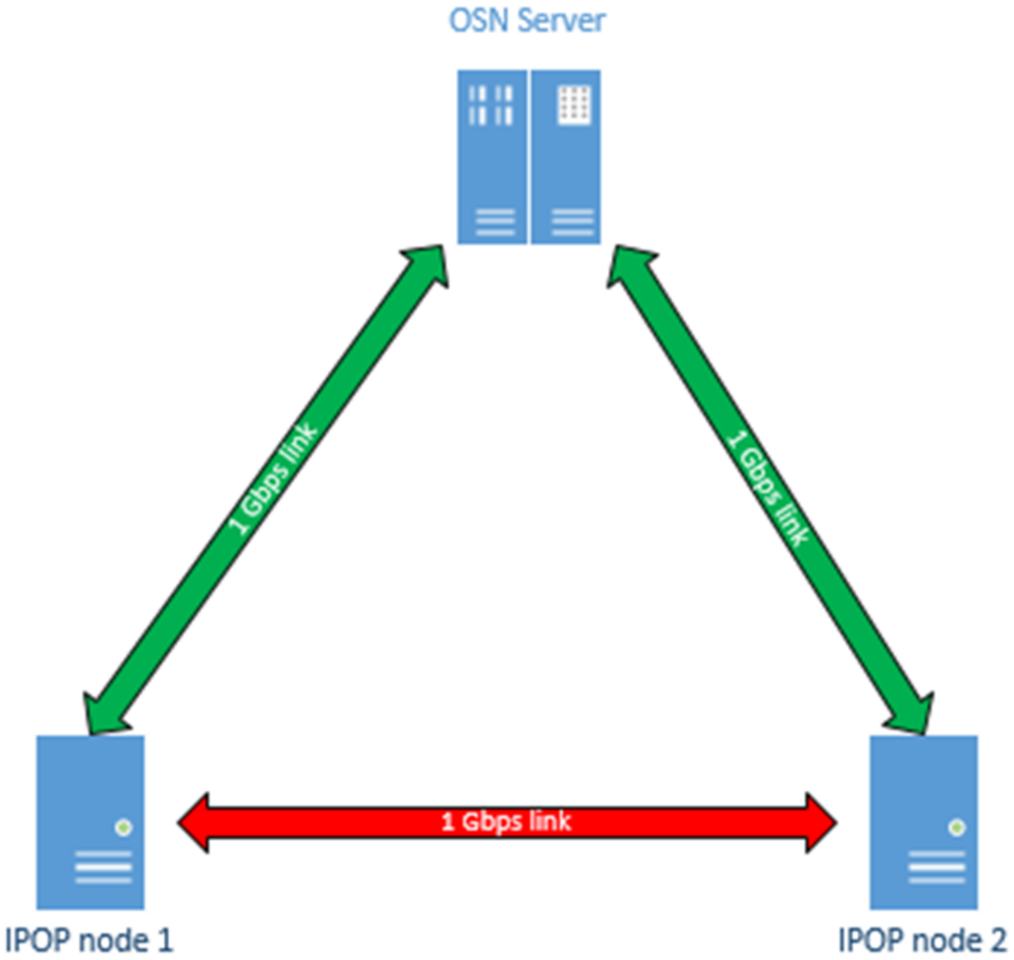
- IP over P2P
- Creates links between users leveraging online social connections
- Can bypass NAT
- Secure links
- It supports existing applications
- Libjingle is used for packet forwarding



Figueiredo, R. (2014) IP over P2P White Paper

Motivation

- IPOP allows users to establish connections in cloud infrastructures
- Performance is bad
  - 260 Mbps average throughput with IPOP
  - 950 Mbps average over direct link
- Performance improvement could enable larger adoption



Research Questions

- What are the sources of the performance overhead?
- What are the solutions?

Starting Ideas

- IPOP assumes that connections are always over insecure networks
- IPOP was not developed with performance in mind
  - Possible inefficiencies in the code

Security Performance

- Uses DTLS as security
- Measurements show increase of ~100% when security is disabled
  - 550 Mbps average throughput for an unsecured connection
  - 260 Mbps average throughput for DTLS connection

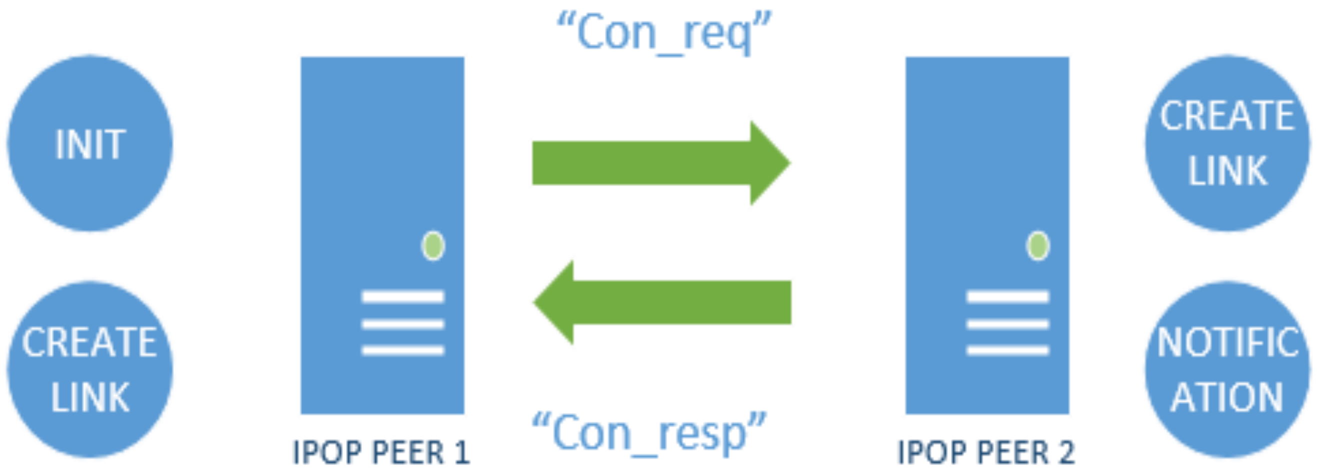
- Cloud Infrastructure use case requires security for a small number of peers
  - Security cannot be enabled selectively for each peer
  - A more granular approach is better

Enabling Selective Security 1

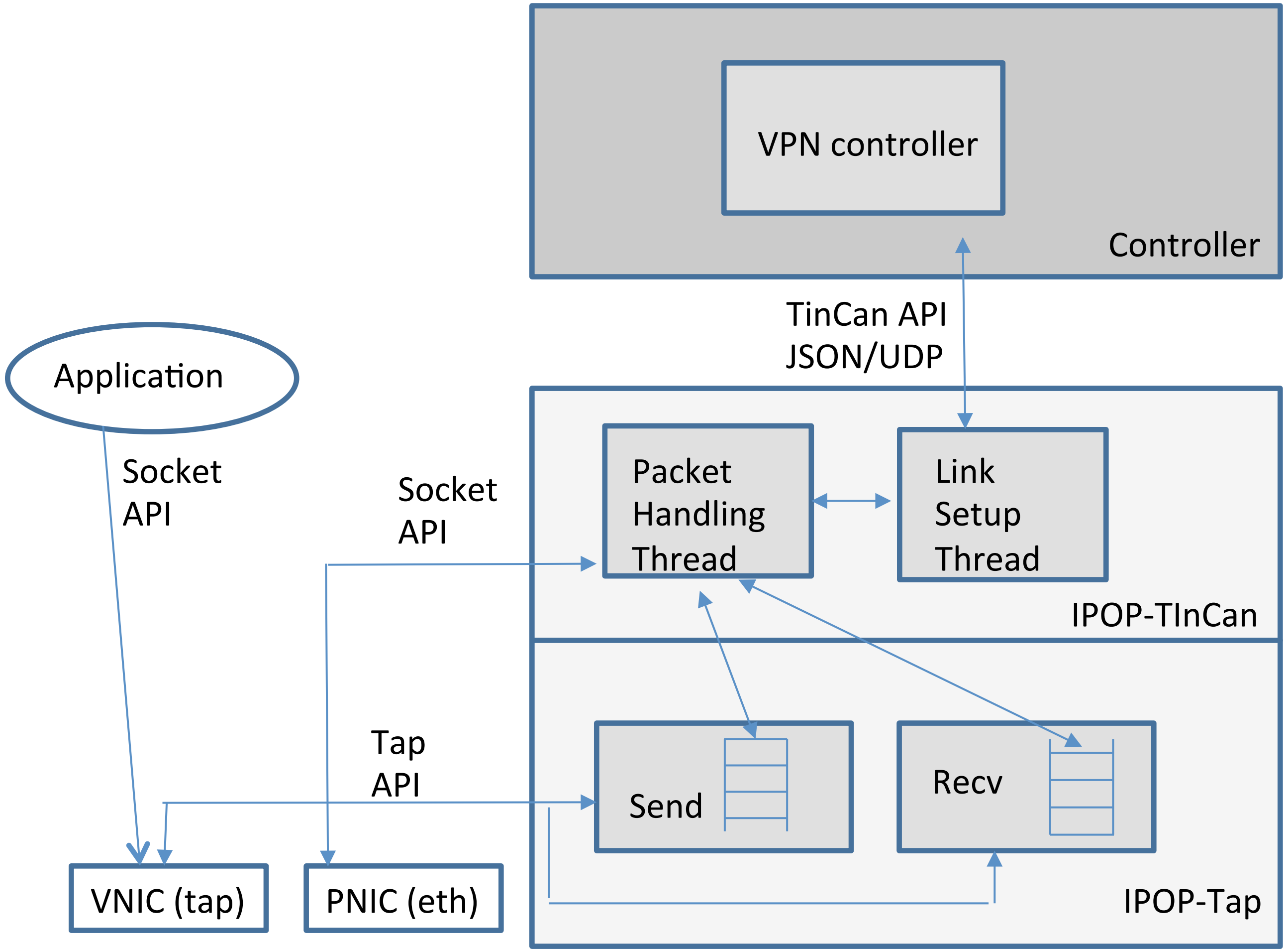
- Easy solution
  - Each IPOP node has an IPOP interface with an associated IP
  - In the local controller configuration file add the IP's associated with the peers with which security should be enabled
  - The list of IP's is checked when creating the link
  - Does not scale
  - It is possible that the IP is not known

Enabling Selective Security 2

- Define a set of groups in the controller configuration file
- Security is enabled if the intersection of the sets is not empty
- Encode group information in “con_req” and “con_resp” messages



Improving Code Performance



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Measurements

- Analyze where time is spent by the processor
  - All debugging symbols were enabled
  - Oprofile
    - Kernel and libc symbols
    - Source code annotated with usage percentage
  - Zoom
    - Presents a top down callgraph
- CPU load measurements
- Timing measurements in the code

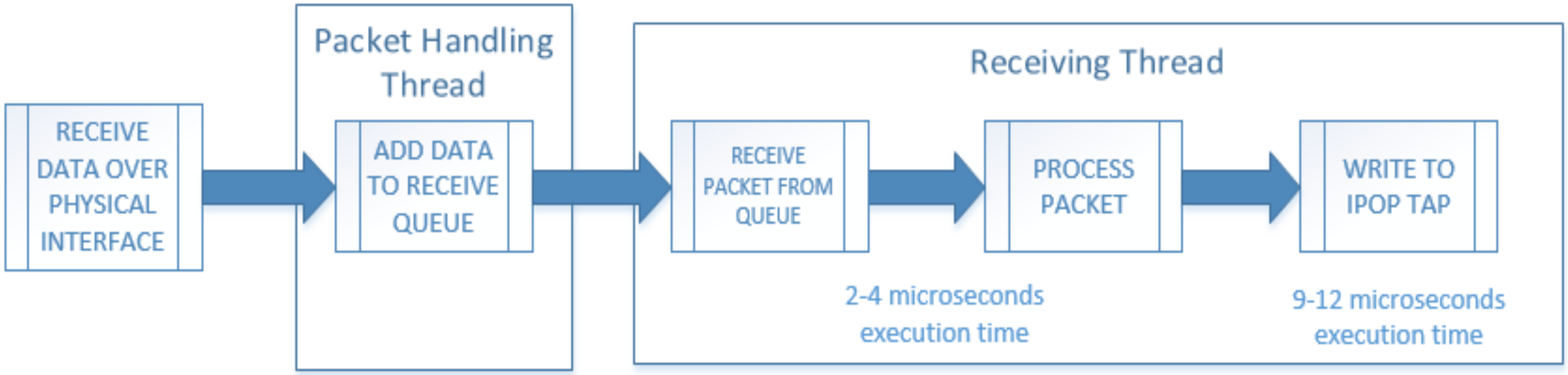
Receiver bottleneck

- Oprofile
  - ~33 million samples in the receiver
  - ~16 million samples in the sender

- Core on which the receiving thread executes is at ~100% on the receiver side

Receiving Packets in IPOP

- Receiving Thread introduces serialization
- Writing to the tap interface is synchronous



Solutions

- Implement the Producer-Consumer pattern
  - Reading is faster that writing => The writing thread does not wait
  - First implementation with no mutex
    - Use conditional signals as a refinement

- Implement asynchronous writes to save time
  - Linux offers two possibilities
    - POSIX AIO – creates multiple writing threads
    - Libaio – actually queues up write requests in the kernel

Current status & Conclusion

Improve performance up by a factor of two and more to come…

- Users have the possibility of a granular security option
- Analysis shows where time is consumed
- Implementation of more efficient packet processing

Future Work

- Find and fix possible bugs
- Investigate other performance bottlenecks
- Discover new use cases for IPOP