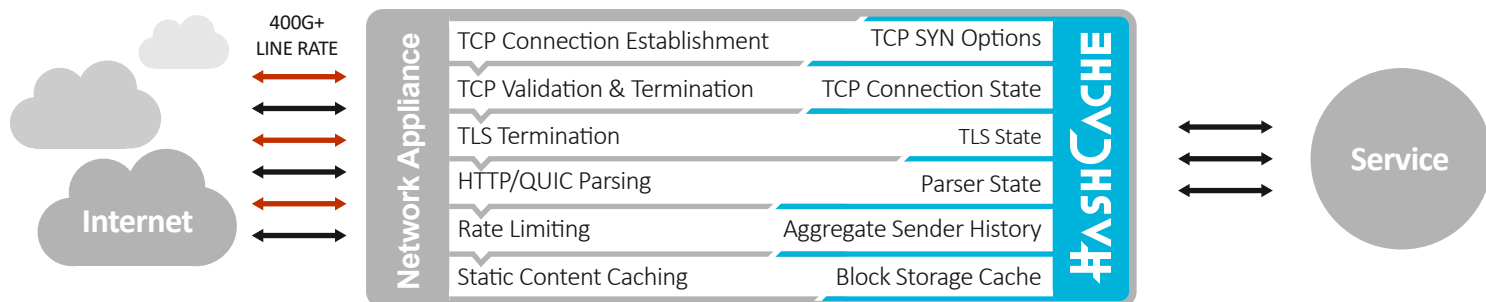# SynoGate HashCache

HASHCACHE FOR STATEFUL NETWORK APPLIANCES

Synogate HashCache manages context for network traffic at extreme speeds. It allows network appliances to process internet traffic packets in the context of the session they belong to, without being vulnerable to DDoS attacks. It can create new session context entries for more than 60 million connections per second and handle hundreds of millions of concurrent connections per memory channel on a single device.

At its heart is an algorithm using Ordered Hash Tables, Linear Probing, and our own replacement strategy called Not Recently Sequenced (NRS) to use memory bandwidth extremely efficiently. It sports sub microsecond latencies and also guarantees that existing sessions will stay in memory for a certain amount of time. Synogate HashCache can be implemented as a digital circuit design on FPGAs or ASICs, and uses conventional DDR4-SDRAM.

Synogate HashCache is the ideal cache management solution for network devices like stateful firewalls, Intrusion Detection Systems, and large-scale TCP/UDP/QUIC servers, that are exposed to large volumes of attack traffic.

400G+ LINE RATE

Internet

Network Appliance

TCP Connection Establishment	TCP SYN Options
TCP Validation & Termination	TCP Connection State
TLS Termination	TLS State
HTTP/QUIC Parsing	Parser State
Rate Limiting	Aggregate Sender History
Static Content Caching	Block Storage Cache

HASHCACHE

Service

THROUGHPUT SCALES LINEARLY

The number of processed packets scales linearly with the number of memory channels due to high parallelism.

COMBINED LUI OPERATIONS

Due to a combined lookup, update, insert and delete operation, on average HashCache needs only 3 memory accesses for worst case traffic and as low as 2.0003 for normal traffic.
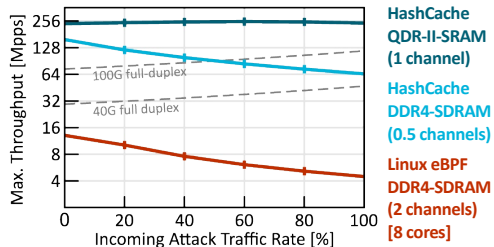
GUARANTEED STATE RETENTION TIME

States have a minimum retention time which scales with the available storage and ensures that even under attack traffic, states of legitimate connections will not be dropped.

LOW STORAGE OVERHEAD

With a storage overhead of only about 4 bytes per entry, HashCache achieves a higher state density than comparable solutions.

Throughput of a stateful network device exposed to attack traffic

Max. Throughput [Mpps]: 256, 128, 64, 32, 16, 8, 4

100G full-duplex

40G full duplex

Incoming Attack Traffic Rate [%]: 0, 20, 40, 60, 80, 100

HashCache QDR-II-SRAM (1 channel)

HashCache DDR4-SDRAM (0.5 channels)

Linux eBPF DDR4-SDRAM (2 channels) [8 cores]

While conventional stateful packet processing solutions struggle to reach 40G, Synogate HashCache can easily handle any line rate even with DDR4-SDRAM by scaling up the number of memory channels.

In the c on the left, throughput is measured with real world traffic and attack traffic. Real world traffic is sourced from an internet exchange, while attack traffic consists of minimal packets that each create a new entry in the state memory.

STATEFUL NETWORK PROCESSING AT LINE RATE

APPLICATIONS

‣ Stateful firewalls
‣ IDS
‣ NAT / CG-NAT
‣ DDoS mitigation
‣ Web & database caching
‣ High frequency trading
‣ Hardware TCP/UDP/QUIC server

FEATURES

‣ Very high insertion rate
‣ High read throughput
‣ Guarantees on state retention time
‣ Low latency (0.2 µs on external SRAM)
‣ SRAM or DRAM
‣ Low storage overhead
‣ Energy consumption < 1 µJ/request

KEY BENEFITS

‣ Stateful processing in exposed networks
‣ Very resilient to DDoS attacks
‣ Designed for insert heavy use cases
‣ Supports billions of states
‣ Enables single device solutions
‣ Significant electricity savings
‣ Reduced TCO

Contact us if you want a demo of HashCache or commission a custom design.