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<http://www.spiegel.de/fotostrecke/qfire-die-vorwaertsverteidigung-der-nsa-fotostrecke-105358.html>

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Getting Close to the Adversary

Forward-based Defense with QFIRE

June 3, 2011

QFIRE Pilot Lead
NSA/Technology Directorate

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Dated: 20070108
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Abstract

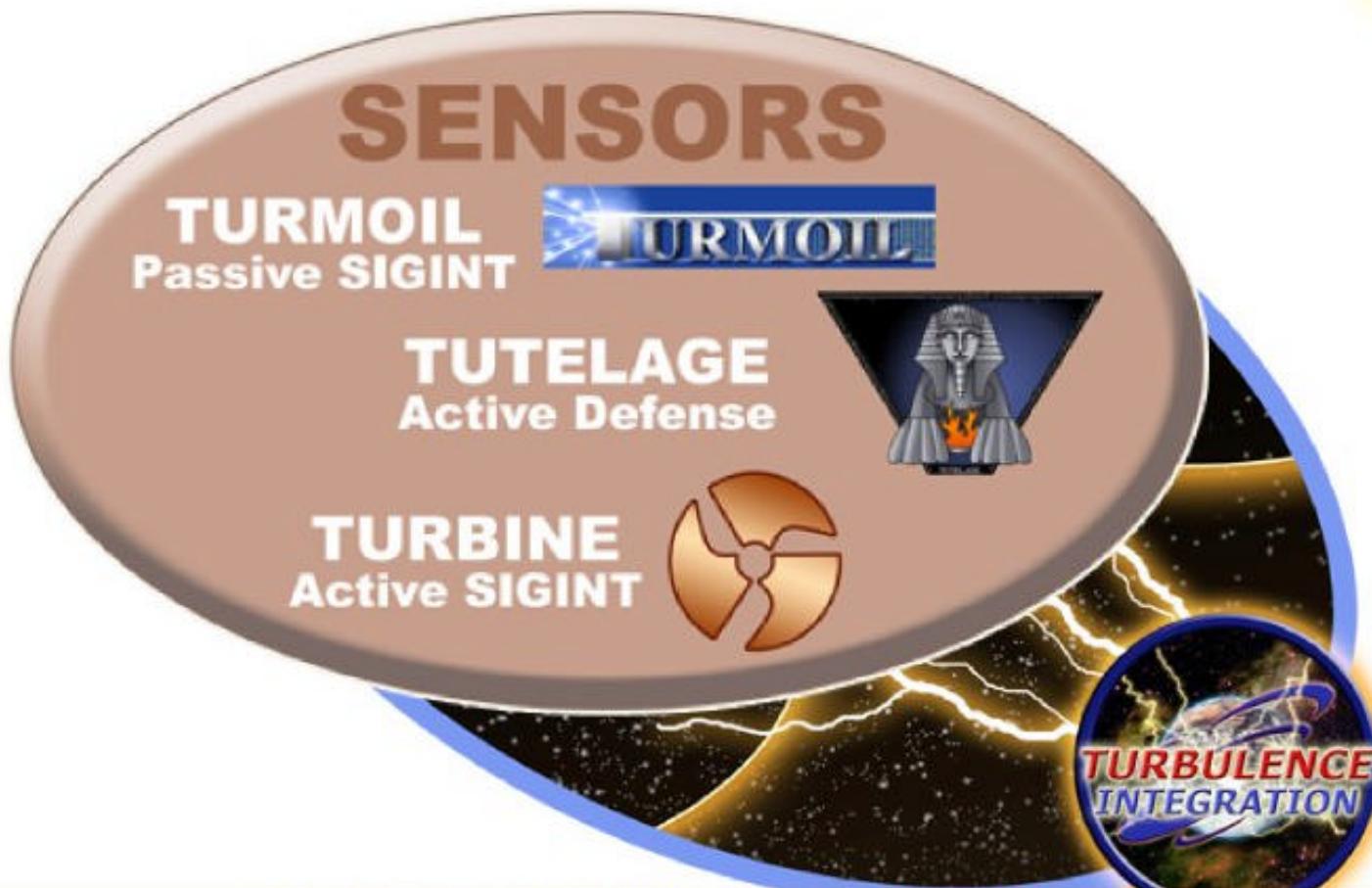
- (TS//SI//REL) The goal of forward-based defense is to detect and mitigate malicious threats in real-time, *as close to the source as possible*. It is part of a layered defense strategy with four concentric zones: endpoint-, perimeter-, aggregation-, and forward-based defenses. The QUANTUMTHEORY mission leverages NSA's vast system of distributed passive sensors to detect target traffic and tip a centralized command/control node. This node assesses the tip and injects a response towards the target using active TAO assets.
- (TS//SI//REL) Extremely powerful CNE/CND/CNA network effects are enabled by integrating our passive and active systems:
 - ***resetting connections***
 - ***redirecting targets for exploitation***
 - ***taking control of IRC bots***
 - ***corrupting file uploads/downloads***
 - ***More!***
- (TS//SI//REL) The success rate of these effects is largely determined by the latency from tip-to-target. **QFIRE** is a consolidated QUANTUMTHEORY platform under development that reduces latencies by co-locating (1) existing passive sensors with (2) local decision resolution, and (3) the ability to locally inject traffic to achieve the desired network effect.



Topics

- ⇒ Layered Defense Model
- ⇒ NSA TURBULENCE Architecture
 - ⇒ TURMOIL passive SIGINT sensors
 - ⇒ TURBINE active SIGINT command/control
- ⇒ QUANTUMTHEORY
 - ⇒ Integrating passive/active systems for CNE/CND/CNA
- ⇒ QFIRE
 - ⇒ Consolidated low-latency QUANTUMTHEORY capability under development for forward-based defense

Forward-based Defense NSA TURBULENCE Architecture



Distributed Sensors: Passive Collection

Accesses



TURMOIL
TUTELAGE



(S//SI//REL) High-speed passive collection systems intercept foreign target satellite, microwave, and cable communications as they transit the globe.



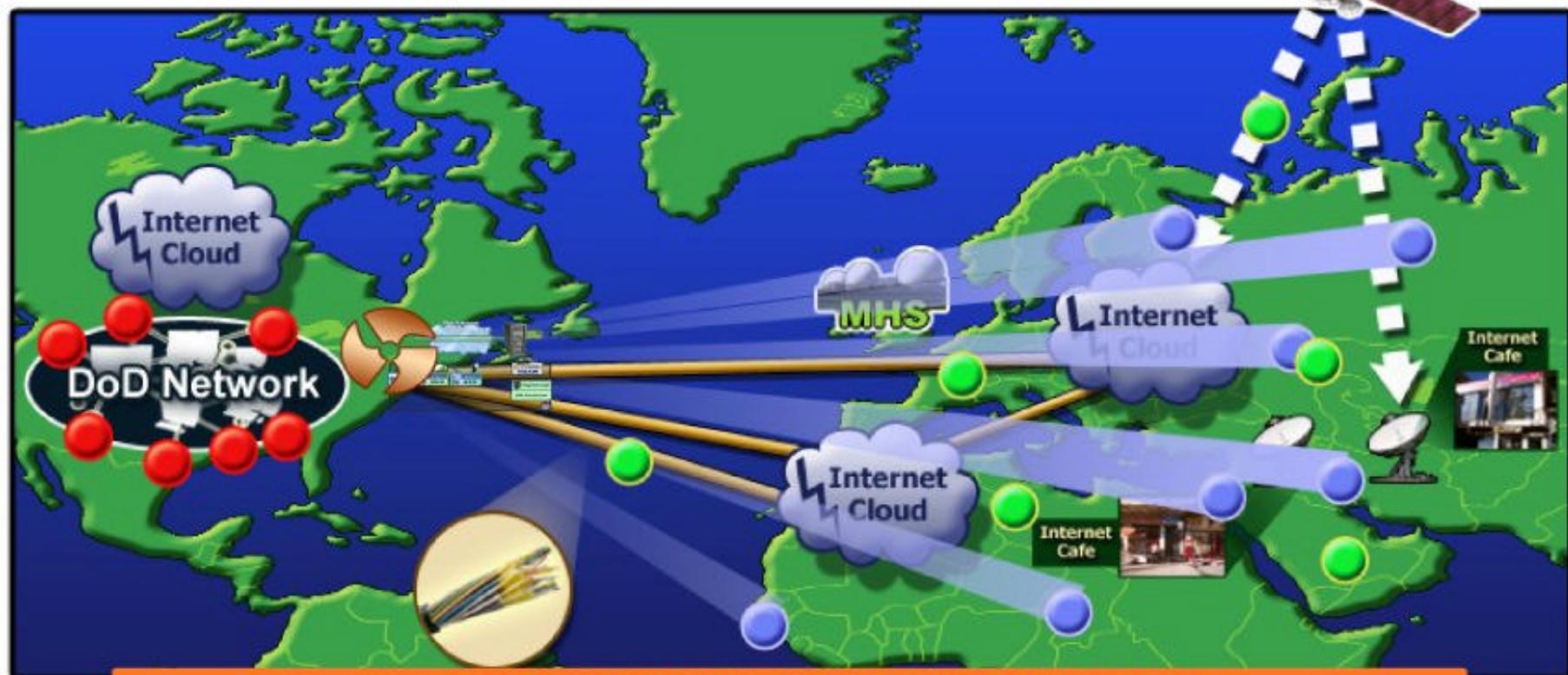
TURBINE: Active Mission Management

Accesses

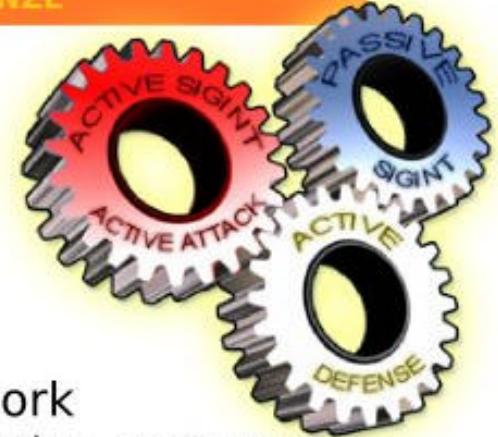
- TURMOIL
- TUTELAGE
- Implants (TAO)



(TS//SI//REL) TURBINE provides centralized automated command/control of a large network of active implants



QUANTUMTHEORY



- ⇒ (TS//SI//REL) Extremely powerful CNE/CND/CNA network effects are enabled by integrating our passive and active systems:
 - ⇒ *Resetting connections (QUANTUMSKY)*
 - ⇒ *Redirecting targets for exploitation (QUANTUMINSERT)*
 - ⇒ *Taking control of IRC bots (QUANTUMBOT)*
 - ⇒ *Corrupting file uploads/downloads (QUANTUMCOPPER)*
- ⇒ (TS//SI//REL) QUANTUMTHEORY dynamically injects packets into a target's network session to achieve CNE/CND/CNA network effects.
 - ⇒ **Detect**: TURMOIL passive sensors detect target traffic & tip TURBINE command/control.
 - ⇒ **Decide**: TURBINE mission logic constructs response & forwards to TAO node.
 - ⇒ **Inject**: TAO node injects response onto Internet towards target.
- ⇒ (TS//SI//REL) The propagation delay from tip-to-target determines the success rate of the network effect. ***Less Latency = More Success!***

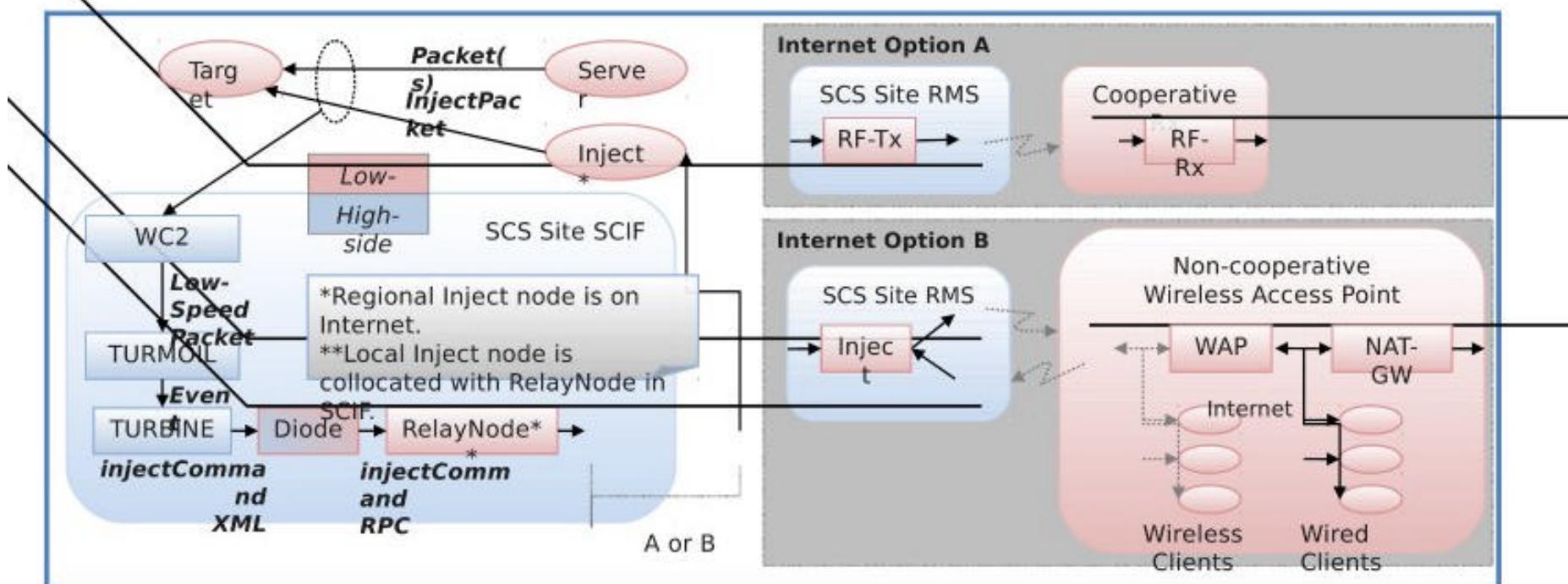
QFIRE: Consolidate for Low Latency

- (TS//SI//REL) Eliminate trans-Atlantic/Pacific latency
 - ⇒ QUANTUMTHEORY Path: **site** ° **NSAW-TURBINE** ° **target**
- (TS//SI//REL) QFIRE collocates at site: sensor, decision logic, and local/regional injection capability to achieve low latency.
 - ⇒ Use existing SIGINT sensors for alerting
 - ⇒ Local decision resolution (local TURBINE)
 - ⇒ Local/regional injection capability
 - ⇒ QFIRE Path: **site** ° **target**
- (TS//SI//REL) A low latency capability substantially increases the variety of achievable CNE/CND/CNA network effects and improves their overall effectiveness.

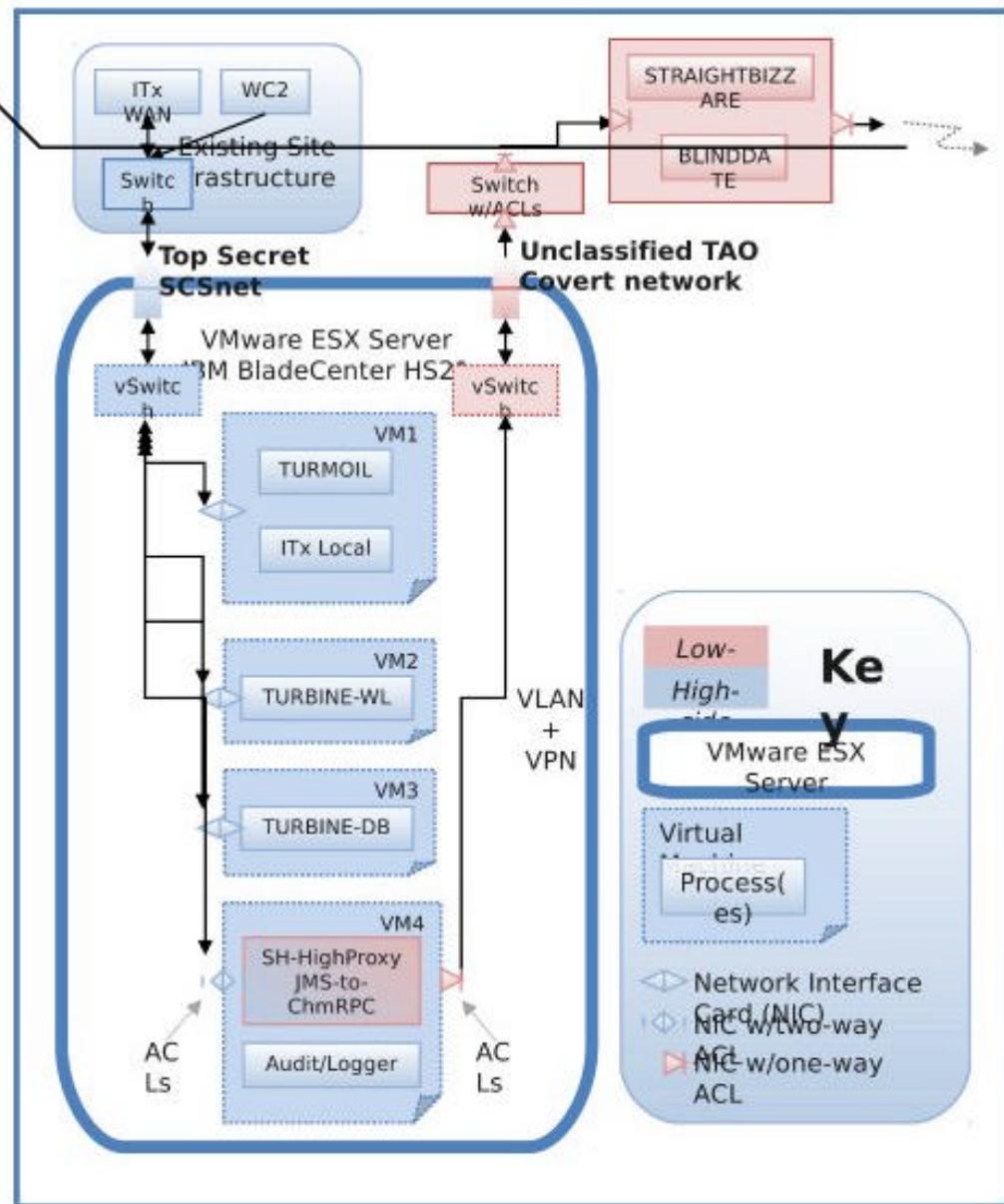
QFIRE/Forward-Based Defense:

- ⇒ QFIRE
 - ⇒ Develop/deploy QFIRE prototype for SCS site(s)
 - ⇒ Conduct time trials & evaluate operational effectiveness
 - ⇒ Develop/deploy QFIRE for high-speed SSO cable site(s)
- ⇒ Dependencies
 - ⇒ Grow regional shooter infrastructure (more Points-of-Presence)
 - ⇒ Develop local/regional insertion capability at SSO cable accesses
 - ⇒ Enhance cloud analytics and QUANTUM missions
 - ⇒ Botnet mitigation pilot effort

QFIRE Components @ SCS



QFIRE @ SCS: Physical/Virtual Network Architecture



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Qu
[REDACTED], [REDACTED]
[REDACTED]@nsa.ic.gov

I iz in ur space-time continuum, upsetting
all your gravity and quantums and stuffs.



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HTTP Web Client/Server

- ⇒ Client initiates request, then server replies
- ⇒ TCP socket:
 - ⇒ Client: TCP SYN
 - ⇒ Server: TCP SYN/ACK
- ⇒ HTTP 1.1 Persistent Connection
 - ⇒ Client: HTTP GET1
 - ⇒ Server: HTTP Response1
 - ⇒ Client: HTTP GET2
 - ⇒ Server: HTTP Response2



QUANTUM INSERT: racing the server

→ The Game:

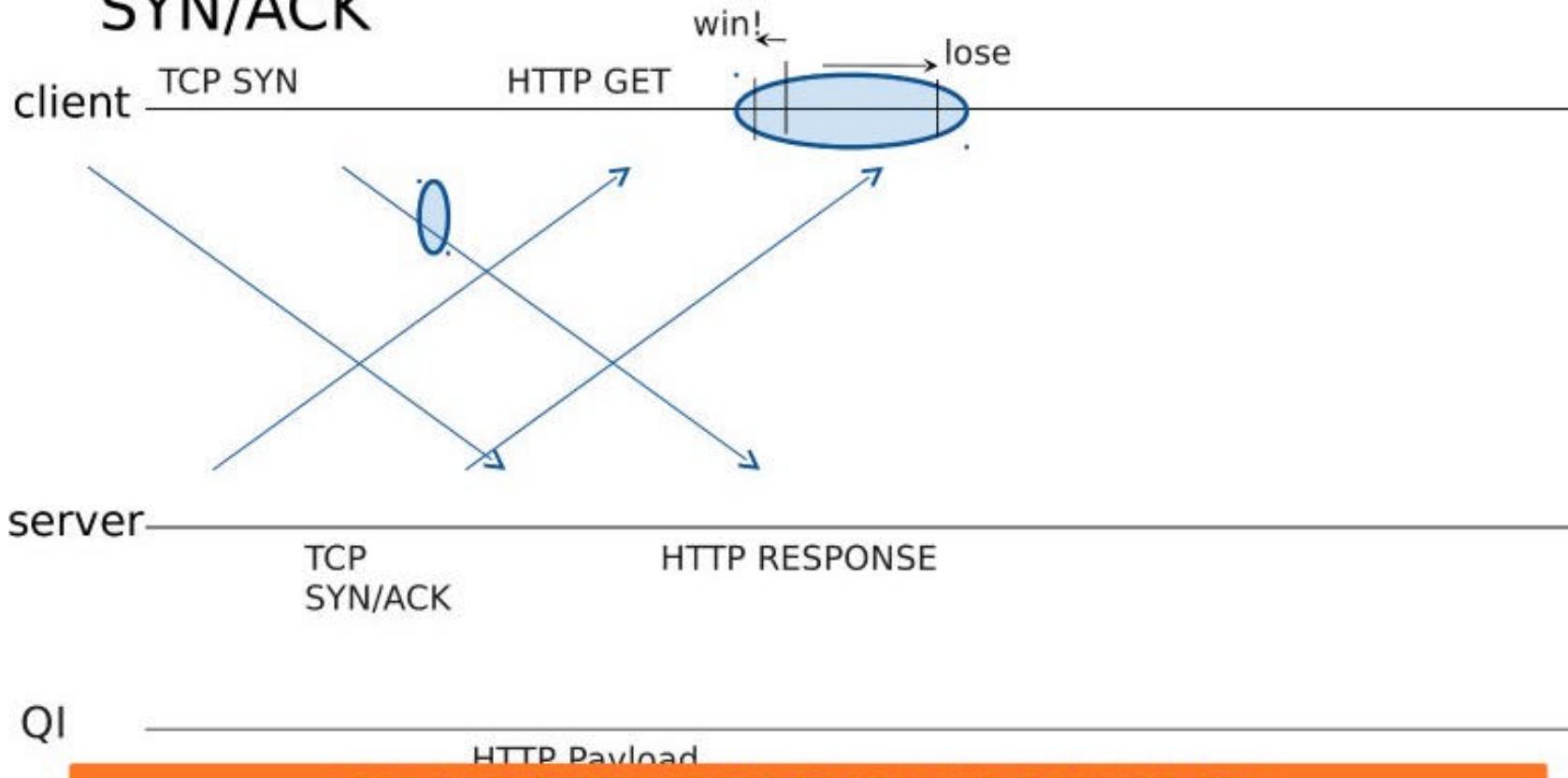
- ⇒ **Wait** for client to initiate new connection
- ⇒ Observe server-to-client TCP SYN/ACK
- ⇒ Shoot! (HTTP Payload)
- ⇒ **Hope** to beat server-to-client HTTP Response

⇒ The Challenge:

- ⇒ Can only win the race on some links/targets
- ⇒ For many links/targets: too slow to win the race!

QUANTUM INSERT: racing the server

QI detects/shoots on server-to-client TCP
SYN/ACK





QUANTUMTHEORY

Latency*

Node	QUANTUMTHEORY Function	Minimum Latency to Reach Next Node (ms)	Total Latency (ms)
SAS	Site Access System: Front end & Layer 0/1	?	?
Stage0	TUMULT: Demux & Layer 2	?	?
Sensor	TURMOIL: Layer 3+Passive Sensor/Event Detection	10	10
ITx	ISLANDTRANSPORT: Enterprise Message Service	120	130
C&C	TURBINE: Command/Control Decision Logic	20	150
Diode	SURPLUSHANGAR: High-to-Low Diode	20	170
CovNet	TAO Covert Network (MIDDLEMAN)	70	240
Inject	TAO injection implant	75	315
Target	Destination for CNE/CND/CNA network effect	--	686

*Timing Measurements, QUANTUMTHEORY Workshop, October 2010