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# **RTVD: A Real-Time Volumetric Detection** Scheme for DDoS in the Internet of Things

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**ABSTRACT** Distributed Denial of Service (DDoS) attacks are increasingly harmful to the cyberspace nowadays. The attackers can now easily launch a bigger and more challenging DDoS attack both towards and with Internet-of-Things (IoT) devices, due to the fast popularization of them. Because of the characteristic of fast overwhelming, it is important to make fast as well as accurate response to DDoS attacks, and the real-time performance can be even more important to prevent and legitimate the attacks. Among the methods proposed by researchers, the entropy-based detection method provides a sensitive and reliable performance. However, the balance between computational complexity and recognition accuracy remains a challenge. In this paper, we propose a detection method that consists of 3 main parts in different aspects: a sliding time window to fasten the entropy calculation, a single-directional filter to realize early detection during the DDoS progress but not after the crash, and a quintile deviation check algorithm to optimize the detection result. These will eventually lead to a real-time and high-efficient performance to recognize IoT DDoS attacks as soon as possible.

**INDEX TERMS** DDoS detection, IoT security, joint entropy, quintile deviation check, real-time detection, sliding time window.

#### **I. INTRODUCTION**

It has been decades since the Distributed Denial-of-Service (DDoS) attack pattern first appeared [1], yet the DDoS attacks are still huge challenges. Traditionally, a Denial-of-Service (DoS) attack is characterized by an explicit attempt by attackers to prevent the legitimate use of a service, and a DDoS attack deploys multiple devices, usually millions of devices, to attain this goal [2]. In September 2016, the website of computer security consultant Brian Krebs was hit with 620 Gbps of traffic. The DDoS attacks can do much faster and more severe harm to the Internet, yet the attacks can be even stealthier than DoS attacks are. Due to the differences

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between DoS and DDoS, the defense strategies can be totally different.

Unfortunately, the security situation is even more severe especially in the era of Internet-of-Things (IoT) today. With the up growing number of IoT devices, attackers can easily take control of far more infected bots than ever before. What's more disturbing is that, the concepts of IoT, such as the modern Internet of Vehicles [3], [4], edge computing [7] and Information-Centric Networking (ICN) [5], [6] etc., are having increasingly stronger computing power [8]. In late 2016, Mirai [9], the ever largest IoT botnet, outbroke in 2016 and launched a DDoS attack on 20th Sept., with the maximum speed of 1.5 Tbps on OVH, the French web host and cloud service provider, and launched another DDoS attack on a DNS management service provider in America, which caused a large-area network paralysis in eastern United States. Many American websites, including Twitter and Facebook, failed to be accessed by their domain names. In the offline event in Germany, attackers launched a flood scan on 7,547 port with Mirai, about 900,000 Deutsche Telekom routers crashed during the campaign, resulting in a large scale of limited network access. In late November 2017, a Mirai variant was found launching attacks on IoT devices in Argentina through port 23 and 2323 [10]. Besides Mirai, there already exist many IoT botnets such as QBOT, Luabot, Bashlight, Zollard, Remaiten, KTN-RM, etc., and most of them provide the DDoS service. In fact, few IoT viruses exclude the function of DDoS because IoT is perfect to launch a DDoS attack, making the DDoS more threatening.

In an original DDoS attack, the attacker controls a huge number of devices and threads to directly consume the resources of the victim servers. A Direct DDoS Attack itself is simple to understand and realize, but the attacker must prepare an attacking network to manage and control all the devices by adopting a botnet or a Trojan virus, which enriches the cost of an attack. To avoid this problem, or to make the attack more dangerous, the strategy of (Amplified) Reflective Attack is proposed. In a reflective DDoS attack, the attacker takes advantage of the vulnerabilities of those protocols which make more responding resources than requesting ones, such as DNS, NTP, SSDP, etc. The attacker designs and sends some fake request packets, which are claimed to be sent from the victims to the servers running those reflective protocols. Usually, the servers won't check whether the source IP addresses are valid or real and will send the query results to the victim IP addresses.

In another classification of flow quantity, DDoS attacks are divided into Volumetric attacks and Low and Slow attacks. Volumetric attacks are the traditional type of DDoS, and they overwhelm the targets by consuming network, storage or computing resources. Huge Volume DDoS attacks send a high amount of traffic or request packets to a targeted network or device to overwhelm its bandwidth capabilities, connection limit or other network resources. In contrast, Low and Slow attacks, also known as low-rate DDoS attacks (LDDoS) or Slow DDoS attacks, are mainly based on the vulnerabilities of layer-7 protocols and involve "what appears to be legitimate traffic at a very slow rate" [11] to occupy and consume the connections. The earliest Slow DDoS is SlowLoris [12], and it is first released by Robert "RSnake" Hansen in June 2009, which allows a single machine to take down another machine's web server with minimal bandwidth and side effects on unrelated services and ports.

Generally, Slow DDoS attacks can go through Volume DDoS detectors, because their packets are usually valid and real, and cause few volume or number of requests, so some researchers claim that Slow DDoS attacks are more technically superior, more dangerous and stealthier than volume attacks. We used to believe that as well, but the reports and data show the result. As is shown in the DDoS Threat Report 2018 Q3 [13], "The maximum attack size increased 139.84% Year-over-Year to 118Gbps", and in the Nexusguard Threat



FIGURE 1. Ranking of different-type ddos attacking vectors [14].

Report (DDoS) 2019 Q3 [14], the top attacking vectors are DNS Amplification, HTTP(S) Flood and TCP SYN Flood, as shown in Fig. 1. Since the Huge Volume DDoS attack is still one of the biggest threats in cyberspace and is turning its attacking mode into a brand-new faster one, it is necessary to make the detection more efficient and flexible.

Volume DDoS attacks flood the target in the hopes of slowing or stopping their services. There are 3 main statistical characteristics of the DDoS traffic:

1) Huge traffic size. As in the big data era today, the in-out traffic of a personal web server can easily come to 1000's of Mbps, and when a DDoS attack occurred, typically, the request sizes are in the 100's of Gbps, and reports show that recent attacks have scaled to over 1Tbps.

2) Various source info. Not only does the source Port vary, but the source IP address also varies in a wide range. Usually, the attackers will use the fast-flux technology [15] and an IP/MAC pool for IP spoofing, or will simply generate fake packet heads for those non-source-IP-check protocols. Considering the huge size of network traffic, the range of values can be shocking.

3) Take the effect quickly. The DDoS attack will arouse a huge number of traffic or requests and crash the target victim in a short duration, which means there will be little interaction time for the detection and following defense against the attack.

In this paper, we focus on fastening the detection of volume type DDoS and designed a real-time alarming system. The contribution of this paper is described as follows:

1) We optimize the method of sliding time window to fasten the entropy calculation algorithm;

2) We design a Quintile Deviation Check algorithm to identify the attacks;

3) We redefine a temporal indicator to evaluate the time performance of DDoS detection.

With the 3 contributions, we realize a real-time volumetric detection scheme for DDoS in the Internet of Things.

The rest of this paper is organized as follows. In Section II, we describe the related works on the usage of the sliding time window and DDoS detection methods. In Section III, we list the nomenclature of all the terms, abbreviations and mathematical symbols used in the following paragraphs. In Section IV, we discuss the detection architecture as well as the mathematical theories that our detection is based on. And we set 3 subsections to explain the concepts of Traffic Processor, Entropy Calculator, and Detection & Alarm Module in detail. In Section V, we make simulations on 3 public datasets and a generated dataset to prove and evaluate the detection scheme we propose. In Section VI, we conclude the whole paper and point out the direction of future research.

#### **II. RELATED WORKS**

Research works have been done with various strategies to detect DDoS attacks with sliding time window or information entropy methods in recent years.

Early in 2006, the sliding window was used in DDoS detection in [16]. The authors use two adjacent non-overlapping windows: the referenced sliding window and the test sliding window, and use an autoregressive model to recognize anomalous traffic. Reference [18] mentioned a real-time DDoS detection technique, using a sliding window and source IP clusters, and using Spark to meet the distributed demands. In years before the DDoS attacks had the characteristics of a relatively fixed number of packets per second, packet bytes, gap periods, etc. However, the situation has changed and the technique of source IP cluster technique won't work as well as before, but other parts of the research provide many inspirations.

In [19], the authors propose a new two-step method for DDoS attack detection, which combines the approaches of network traffic entropy and the TSK Fuzzy System (TSK-FS), and shows that the TSK-FS DDoS detector reaches enhanced sensitivity and robustness in the detection process. Reference [20] shows a method to identify DDoS attacks by computing entropy and frequency-sorted distributions of selected packet attributes. The authors also use the sliding window to simplify the computation of the entropy, which fastens the calculation, but they didn't discuss the aspect of accuracy in detail. In [21] the authors study information-theoretic methods to detect intrusions in the network. They consider the usage of entropy, conditional entropy and information gain to help partition and setting parameters for existing detection models. On this basis, Virmani et al. proposed an entropy deviation method for network intrusion analysis [22]. They used the variation value of source IP entropy packet-by-packet to classify the benign (trusted) and malicious IP addresses. Reference [17] presented a DDoS attack detection and mitigation system with Software Defined Network (SDN). They collected the network traffic information using the SDN controller and sFlow agents in advance and then identified abnormal network traffic with an entropy-based method and a Support

#### TABLE 1. TFOR of different DDoS attacks using QuinDC.

Abbr. or Symbol	Description and Definition				
(D)DoS	(Distributed) Denial of Service.				
LDDOS	Low-rate Distributed Denial of Service.				
5-Tuple	RFC 5766 defined basic information segements in				
	the header of a network packet, which consists of				
	"source IP, source port, destination IP, destination				
	port and protocol".				
s IP/d IP	Source/destination IP address.				
s Port/d Port	Source/destination port number.				
Src. Dst. P	The source segments destination segments and				
	protocol of a 5-tuple.				
LSTM	Long Short-Term Memory, one of the Recurrent				
20101	Neural Betwork (RNN) model usually used in				
	time sequence prediction and natural language				
	processing (NI P)				
OuinDC	Quintile Deviation Check				
Low Low Lo	5 subintervals in OuinDC i.e. Divergent Interval				
$I_{DU}, I_{SU}, I_{C}, I_{DD}$	(Unward) Shock Interval (Unward) Convergent				
$^{1SD}, ^{1DD}$	Interval Shock Interval (Downward) and Diver				
	ant Interval (Downward)				
EDD END EOD	Ealse Positive Pate Ealse Negative Pate and Ealse				
TTK, TNK, TOK	Omission Pate Popular indices of performance				
	evaluation				
TEOP	Temporal False Omission Pate Pased on tratid				
IFUK	interioral False Omission Rate, and take temperal interior				
	the exploration				
5	A given time sequence.				
n	The width of a aliding window				
	The width of a shall g window. $C C$				
$S_x$	The $x^{m}$ w-length subsequence of S.				
$\Pi(x)$	The entropy value of $S_x$ .				
e / ·	Element that appears in $S_x$ .				
$e_{In}/e_{Out}$	The read-in/pushed-out element.				
$\Delta x$	Deviation value of $x$ .				
	Array of dictionaries.				
$d_x$	The $x^{in}$ dictionary in D.				
	The matrix of value counters.				
$v_x$	The value vector of $d_x$ .				
lb	The length of how many elements that the LSTM				
	model will look back, also means the input length.				
<i>p</i>	The predicted output value.				
N	The length of sliding window in QuinDC.				
k	The group length in QuinDC.				
$\phi$	The threshold parameter in QuinDC.				
$e_{max}, e_{min}, e$	The maximum, minimum and average value of				
	the first $\phi$ entropy values in the previous sliding				
	window.				

Vector Machine (SVM) classifier. Other researches also mentioned detection or mitigation methods such as Threat Intelligence (TI) information sharing [23] and command lines analysis [24].

Based on all the researches above, entropy works well in the DDoS detection scenario, but the balance between efficiency and accuracy is a big challenge. The mentioned reference [20] uses a sliding window to optimize the time performance, and base on that, our research in this paper does further progress.

#### **III. NOMENCLATURE**

To make a clearer expression, in this section, we list all the terms, abbreviations and mathematical symbols that are used in the following paragraphs, as well as their descriptions and definitions.



FIGURE 2. DDoS detection architecture.

# IV. DETECTION ARCHITECTURE AND MATHEMATICAL THEORIES

The detection system consists of 3 parts: a traffic processor, an entropy calculator, and a detection module, and the architecture is shown in Fig. 2. The traffic processor monitors the traffic in the whole network, preprocesses the traffic data and then forwards the data to the entropy calculator. The entropy calculator calculates the real-time entropy values and sends the values to the detection module. The detection module matches the entropy values with the given risk models and decides whether to send out an alarm. In the following sections, we will introduce the mechanism and theories of the 3 parts in detail.

# A. TRAFFIC PROCESSOR

1) MONITORING AND THE TIMESTAMP ATTACHED 5-TUPLES

Due to the existence of security vulnerabilities in traditional network architectures, DDoS attacks are becoming increasingly dangerous. To contain the consequence and also to trace the attacks, the industry and academia proposed the concept of software-defined network (SDN), whose centralized control network provides support for the defense against DDoS attacks [25]. Within an SDN environment, we can trace and filter the DDoS traffic, can get the traffic packet in real-time and can make real-time detection and defense.

Since we can get real-time traffic packets, the next thing that matters most is to extract the concerned segments from the input data. The traditional Request-For-Comments (RFC)-defined traffic identifier is the 5-Tuple [26], [27]: [Source IP, Source Port, Destination IP, Destination Port, Protocol]. Analysts use 5-tuples to distinguish between different



FIGURE 3. Flow chart of single directional packet filter.

network flows. Using 5-tuple only will lose time-domain characteristics. To solve this problem, we also append the timestamp of each packet to the tuple as the expiring threshold variable.

# 2) SINGLE DIRECTIONAL PACKET FILTER

A complete DDoS attack can be divided into 3 stages of preparing, attack accumulating, and saturation. The attackers collect the necessary information and intelligence of the target victims and deploy botnets of Trojans during the preparation stage. After the preparation, the attackers send out a command to launch the attack. As the connection numbers, network resources or computing resources are being gradually occupied, the service capacity keeps declining, and the victims will finally be unable to respond. Most detection methods are based on this characteristic, but this means the attackers have already fulfilled their goals. If we want to prevent the attack before the victims paralyzed, we must further shorten the responding time and latency. However, another problem is that, during the accumulating stage. the victim server can still make responses to the packets, including the malicious ones. We will not only see the victims' IP addresses in the destination IP segment but also see as many attackers' and legal users' IP addresses as well. This will lead to a failure in applying entropy detection until the attack enters the saturation stage.

To eliminate the influences from the victims' response packets, a popular approach is to use flow information instead of packet information, because the network traffic flow will keep only the first packet in the flow. However, this will also lead to false statistical characteristics. Popular flow extractors (e.g., bro and tshark) usually work on a captured pcap file and

		restimution		
35721 15.575	145 1.200.107.48	1.128.0.172	RTP	226 PT=ITU-T G.711 PCMU, SSRC=0x8653F156, Seq=29230,
35722 15.584	163 1.128.0.8	1.200.111.9	RTP	226 PT=ITU-T G.711 PCMU, SSRC=P+71530880, Sog=53873
35723 15.584	164 1.200.111.9	1,128,0,8	RTP	226 PT-ITU-T G.711 PCMU, SSRC-I Reckaround 5.
35724 15, 594	596 1.128.0.172	1.200.107.48	RTP	226 PT=TTU-T 6,711 PCMU, SSRC=1,715,715
35725 15 594	596 1 200 107 48	1 128 0 172	RTD	226 PT-TTU-T & 711 PCMU SSPC-H-962 Packets 2021
25725 45.504	4 400 0 0	1.110.011/1	070	DOG DT TTU T G 744 DOWL CODE L DESCRIPTION
33720 13.004	532 1.120.0.0	1.200.111.5	NIF .	220 FT=110-T G./11 FCHD, 33NC=0x/1323000, 3eq-320/4;
35/2/ 15.684	953 1.200.111.9	1.128.0.8	RIP	226 PI=110-1 G./11 PCMU, SSRC=0x8653F156, Seq=29356,
35728 15.614	304 1.128.0.172	1.200.107.48	RTP	226 PT=ITU-T G.711 PCMU, SSRC=0x715298B0, Seq=52750,
35729 15.614	304 1.200.107.48	1.128.0.172	RTP	226 PT=ITU-T G.711 PCMU, SSRC=0x8653F156, Seq=29232,
35730 15,624	612 1.128.0.8	1,200,111,9	RTP	226 PT=ITU-T G.711 PCMU, SSRC=0x71529880, Seg=52875,
35731 15.624	613 1.200.111.9	1,128,0,8	RTP	226 PT=TTU-T_G.711 PCNU, SSRC=0x8653E156, Seg=29357
25722 15 625	215 1 132 0 173	1 300 107 49	PTD	236 PT-TTU T C 711 PCNU SERC-0+71530980 Sem=53751
35732 15.035	313 1.120.0.172	1.200.107.40	070	220 PT-110-1 G.711 PCH0, 33%C-0X/1325000, 3eq-32/31,
35/35 15.635	510 1.200.107.40	1.120.0.172	ALC: Y	220 PT=110-1 G./11 PCHU, SSRC=0X0053F150, Seq=29235,
35734 15.644	496 1.128.0.8	1.200.111.9	RTP	226 PT=ITU-T G.711 PCMU, SSRC=0x715298B0, Seq=52876,
35735 15.644	497 1.200.111.9	1.128.0.8	RTP	226 PT=ITU-T G.711 PCMU, SSRC=0x8653F156, Seq=29358,
35736 15.654	952 1.128.0.172	1.200.107.48	RTP	226 PT=ITU-T G.711 PCMU, SSRC=0x715298B0, Seq=52752,
35737 15.654	953 1.200.107.48	1.128.0.172	RTP	226 PT-ITU-T G.711 PCMU, SSRC-0x8653F156, Seg-29234,
35738 15,664	367 1.128.0.8	1,200,111,9	RTP	226 PT=ITU-T G.711 PCMU, SSRC=0x71529880, Seg=52877
35739 15 664	368 1 289 111 9	1 128 8 8	RTP	226 PT=TTU-T 6 711 PCNU SSRC=8v8653E156 Sec=29359
35740 15 674	755 1 139 0 173	1 300 107 49	PTD	236 PT_TTU T 6 711 PCMU SSPC_0v71530900 Soc_53753
55740 15.074	///	1.200.107.40	ALL P	220 FT-110-T G.711 FCH0, 35MC-0X71525000, 3Eq-52755,
35741 15.674	/55 1.200.107.48	1.128.0.172	KIP	226 PT=110-1 G./11 PCMU, SSRC=0x8653F156, Seq=29235,
35742 15.684	155 1.128.0.8	1.200.111.9	RTP	226 PT-ITU-T G.711 PCMU, SSRC-0x715298B0, Seq-52878,
35743 15.684	156 1.200.111.9	1.128.0.8	RTP	226 PT-ITU-T G.711 PCMU, SSRC-0x8653F156, Seq-29360,
35744 15.694	533 1.128.0.172	1.200.107.48	RTP	226 PT-ITU-T G.711 PCMU, SSRC-0x715298B0, Seq-52754,
35745 15.694	534 1.200.107.48	1.128.0.172	RTP	226 PT=ITU-T G.711 PCMU, SSRC=0x8653F156, Seq=29236,
35746 15 784	917 1 128 8 8	1 288 111 9	RTP	226 PT=TTU-T_6_711 PCMU_SSRC=8x71529888_Sec=52879
35747 15 704	919 1 209 111 9	1 129 0 9	PTP	226 PT-TTU T & 711 PCMU SSPC-0v96535156 Soc-20361
26749 45 704	227 1 120 0 172	1 200 107 10	870	236 DT-TTU T C 711 DOWL SCRC-0-71530800 C 5375
35748 15.714	1.128.0.172	1.200.107.48	RIP	220 FT=110-1 G./11 PUPU, SSRU=82/1529888, Seq=52755,
35749 15.714	1.200.107.48	1.128.0.172	RTP	226 PI=110-T G.711 PCMU, SSRC=0x8653F156, Seq=29237,
35750 15.724	721 1.128.0.8	1.200.111.9	RTP	226 PT=ITU-T G.711 PCMU, SSRC=0x715298B0, Seq=52880,
35751 15.724	721 1.200.111.9	1.128.0.8	RTP	226 PT=ITU-T G.711 PCMU, SSRC=0x8653F156, Seq=29362,
35752 15,734	555 1.128.0.172	1,200,107,48	RTP	226 PT=ITU-T G.711 PCMU, SSRC=0x71529880, Seg=52756.
35753 15, 734	556 1.200.107.48	1,128,0,172	RTP	226 PT=TTU-T_6.711 PCNU, SSRC=8x8653E156, Seg=29238
35754 15 744	911 1 128 0 8	1 200 111 9	RTD	226 PT=TTU_T_C_711 PCMU_SSRC=0v715208R0_Sec=52881
26766 16 744	012 1 200 111 0	1 139 0 9	RTO	236 DT-TTU T C 711 DCMU SERC-0.96520166 Ser-30363
33733 13.744	512 1.200.111.5	1.120.0.0	NIF .	220 FT=110-T G.711 FCHD, 33KC=0X0033F130, 3eq=29303,
35/56 15./54	292 1.128.0.172	1.200.107.48	RIP	226 PT=110-1 G./11 PCMU, SSRC=0x/1529880, Seq=52/5/,
35757 15.754	293 1.200.107.48	1.128.0.172	RTP	226 PT=ITU-T G.711 PCMU, SSRC=0x8653F156, Seq=29239,
35758 15.764	613 1.128.0.8	1.200.111.9	RTP	226 PT=ITU-T G.711 PCMU, SSRC=0x715298B0, Seq=52882,
35759 15.764	614 1.200.111.9	1.128.0.8	RTP	226 PT=ITU-T G.711 PCMU, SSRC=0x8653F156, Seq=29364,
35760 15.775	387 1.128.0.172	1.200.107.48	RTP	226 PT=ITU-T G.711 PCMU, SSRC=0x715298B0, Seq=52758,
35761 15,775	387 1.200.107.48	1,128,0,172	RTP	226 PT=TTU-T_G.711 PCNU, SSRC=0x8653E156, Sed=29240
25763 15 794	1 1 1 1 1 1			
		1 200 111 9	RTP	226 PT=TTU-T_G_711 PCMU_SSRC=0v71529880_Sag=52883
35762 15.764	201 1 200 111 0	1.200.111.9	RTP	226 PT-ITU-T G.711 PCNU, SSRC-0x71529880, Seq=52883,
35763 15.784	390 1.120.0.0 391 1.200.111.9	1.200.111.9 1.128.0.8	RTP	226 PT-ITU-T G.711 PCMU, SSRC-0x71529880, Seq-52883, 226 PT-ITU-T G.711 PCMU, SSRC-0x8653F156, Seq-29365,
35763 15.784 35764 16.232	390         1.128.0.8           391         1.200.111.9           017         1.1.90.75	1.200.111.9 1.128.0.8 1.200.0.7	RTP RTP TCP	226 PT-ITU-T G.711 PCNU, SSRC-0x71529880, Seq-52883, 226 PT-ITU-T G.711 PCNU, SSRC-0x8653F156, Seq-29365, 70 26710 → 80 [SYN] Seq-0 Win-5792 Len-0 MSS-1460 T
35763 15.784 35764 16.232 35765 16.232	390         1.128.0.0           391         1.200.111.9           017         1.1.90.75           017         1.1.90.42	1.200.111.9 1.128.0.8 1.200.0.7 1.200.0.10	RTP RTP TCP TCP	226 PT-ITU-T G.711 PCMU, SSRC-0x71529880, Seq-52883, 226 PT-ITU-T G.711 PCMU, SSRC-0x8653F156, Seq-29365, 70 26770 + 80 [SYN] Seq+0 Min-5792 Len+0 MSS-1460 T 70 26740 + 80 [SYN] Seq+0 Min-5792 Len+0 MSS-1460 T
35763 15.784 35764 16.232 35765 16.232 35766 16.232	390         1.128.0.8           391         1.200.111.9           017         1.1.90.75           017         1.1.90.42           018         1.1.238.47	1.200.111.9 1.128.0.8 1.200.0.7 1.200.0.10 1.200.0.9	RTP RTP TCP TCP TCP	226 PT-ITU-T G.711 PCNB, 558C-06871520880, 5eq-5283, 226 PT-ITU-T G.711 PCNB, 558C-06857155, 5eq-2385, 70 26710 + 80 [SYN] Seq-0 Min-5792 Len-0 MS5-1460 T 70 26724 + 80 [SYN] Seq-0 Min-5792 Len-0 MS5-1460 T 70 26724 + 80 [SYN] Seq-0 Min-5792 Len-0 MS5-1460 T
35763 15.784 35764 16.232 35765 16.232 35766 16.232 35767 16.232	390         1.128.0.8           391         1.200.111.9           017         1.1.90.75           017         1.1.90.42           018         1.1.238.47           018         1.1.90.53	1.200.111.9 1.128.0.8 1.200.0.7 1.200.0.10 1.200.0.9 1.200.0.9	RTP RTP TCP TCP TCP TCP	226 PT-TU-T G.711 PCNU, SSRC-0x73229889, Seq-22883, 226 PT-TU-T G.711 PCNU, SSRC-0x68537155, Seq-22895, 70 26710 = 80 [SVN] Seq-0 Min-5792 Len-0 MS5-1468 70 26740 = 80 [SVN] Seq-0 Min-5792 Len-0 MS5-1468 70 26721 = 80 [SVN] Seq-0 Min-1792 Len-0 MS5-1468 70 54368 = 80 [SVN] Seq-0 Min-1792 Len-0 MS5-1468
35763 15.784 35763 15.784 35764 16.232 35765 16.232 35766 16.232 35767 16.232 35768 16.232	390         1.120.0.0           391         1.200.111.9           017         1.1.90.75           017         1.1.90.42           018         1.1.238.47           018         1.1.90.31	1,200,111,9 1,128,0,8 1,200,0,7 1,200,0,10 1,200,0,9 1,200,0,8 1,200,0,7	RTP RTP TCP TCP TCP TCP TCP	226 PT-TU-T G.711 PCNU, 558C-0+6731220880, 5eq-2383, 226 PT-TU-T G.711 PCNU, 558C-0+6731220880, 5eq-2383, 70 26710 + 80 [SYN] Seq-0 Min-5792 Len-0 MSS-1460 70 26720 + 80 [SYN] Seq-0 Min-5792 Len-0 MSS-1460 70 26721 + 80 [SYN] Seq-0 Min LOIC SYN 70 54404 + 80 [SYN] Seq-0 Min LOIC SYN 70 54404 + 80 [SYN] Seq-0 Min LOIC SYN 70 54404 + 80 [SYN] Seq-0 Min LOIC DALA
35763 15.784 35764 16.232 35765 16.232 35766 16.232 35767 16.232 35768 16.232 35768 16.232	390         1.120.0.0           391         1.200.111.9           817         1.1.90.75           917         1.1.90.42           918         1.1.238.47           918         1.1.90.53           918         1.1.90.31           918         1.1.28.58	1.200.111.9 1.128.0.8 1.200.0.7 1.200.0.9 1.200.0.9 1.200.0.9 1.200.0.7 1.200.0.7 1.200.0.3	RTP RTP TCP TCP TCP TCP TCP	226 PT-TU-T G.711 PWU, 558C-97353980, 5ee-2383, 226 PT-TU-T G.711 PWU, 558C-9855156, 5ee-2385, 226 PT-TU-T G.711 PWU, 558C-9855156, 5ee-2385, 226 PT-270 Lene M55-1460 T 26 2764 P 05 [591] Seq-0 Min-570 Lene M55-1460 T 26 2764 PB (591) Seq-0 Mi LOIC SYN T 26 5468 PB (591) Seq-0 Mi LOIC SYN T 26 5464 PB (591) Seq-0 Mi Flood Packets T 26 5491 PB (591) Seq-0 Mi Flood Packets T
35763 15.784 35763 15.784 35764 16.232 35765 16.232 35766 16.232 35767 16.232 35768 16.232 35769 16.232 35769 16.232	330         1.128.0.0           331         1.200.111.9           017         1.1.90.75           018         1.1.90.42           018         1.1.28.47           018         1.1.90.31           018         1.1.28.58           018         1.1.28.58           018         1.1.28.58           018         1.1.28.58	1.200.111.9 1.128.0.8 1.200.0.7 1.200.0.10 1.200.0.9 1.200.0.9 1.200.0.8 1.200.0.7 1.200.0.3 1.200.0.3	RTP RTP TCP TCP TCP TCP TCP	226 PT-TU-T 6.711 CPU, 556C-677322889, 549-5283 226 PT-TU-T 6.711 CPU, 556C-68533155, 549-2365, 70 2774 - 80 [571] 5494 [574] 5494 [5752] 5494 [5752] 5494 70 2774 - 80 [571] 5494 [572] 5494 [5752] 5494 [5752] 5494 70 5438 - 80 [571] 5494 [571] 5494 [572] 5494 [572] 5494 70 5438 - 80 [571] 5494 [571] 5494 [572] 5494 [572] 5494 70 5438 - 80 [571] 5494 [574] 5494 [572] 5494 [575] 5494 70 5438 - 80 [571] 5494 [574] 5494 [575] 5494 [575] 5494 [575] 5494
35763 15.784 35763 15.784 35765 16.232 35765 16.232 35767 16.232 35768 16.232 35769 16.232 35779 16.232 35779 16.232	330         1.128.0.8           311         1.208.111.9           017         1.1.90.75           017         1.1.90.42           018         1.1.90.53           018         1.1.90.53           018         1.1.90.31           018         1.1.238.58           018         1.1.238.58           018         1.1.238.69	1.280.111.9 1.228.0.8 1.200.0.7 1.200.0.9 1.200.0.9 1.200.0.8 1.200.0.7 1.200.0.7 1.200.0.3 1.200.0.8 1.200.0.8 1.200.0.8	RTP RTP TCP TCP TCP TCP TCP TCP	226 FT-TU-T 6.7.11 CPU, 555-C+7.152808, 545-5283 226 FT-TU-T 6.7.11 CPU, 555-C+6853135, 545-24935, 70 57218 - 80 [271] 5454 547-5722 [cme8 555-5480] 70 57218 - 80 [271] 5454 547 [271] 5476 555-5480 70 5545 - 80 [271] 5459 4 LOIC SYN 70 5475 - 80 [271] 5450 5 LOIC SYN 70 5475 - 80 [271] 5475 5 LOIC SYN 70 5575 - 80 [271] 5475 5 LO
35763 15.784 35764 16.232 35765 16.232 35766 16.232 35768 16.232 35768 16.232 35768 16.232 35769 16.232 35778 16.232 35770 16.232	336         1.123.0.8           311         1.208.111.9           017         1.1.90.75           018         1.1.238.42           018         1.1.238.33           018         1.1.90.53           018         1.1.238.35           018         1.1.238.36           019         1.1.238.36	1.200.111.9 1.228.0.8 1.200.0.7 1.200.0.9 1.200.0.9 1.200.0.7 1.200.0.7 1.200.0.7 1.200.0.3 1.200.0.3 1.200.0.3 1.200.0.11 1.200.0.6	RTP RTP TCP TCP TCP TCP TCP TCP TCP	226 PT-TU-T 6.711 CPU, 557C-6771522889, 549-5283 226 PT-TU-T 6.711 CPU, 557C-648337155, 549-22935; 70 25721 = N0 [SYN] 549-01 (IA-5722 Lenel PTS-1640 1 70 25721 = N0 [SYN] 549-01 (IA-5722 Lenel PTS-1640 1 70 3548 = N0 [SYN] 549-01 (IA-5722 Lenel PTS-1640 1 70 4548 = N0 [SYN] 549-01 (IA-5722 Lenel PTS-1640 1 70 4573 = N0 [SYN] 549-01 (IA-5722 Lenel PTS-1640 1 70 4572 = N0 [SYN] 549-01 (IA-5722 Lenel PTS-1640 1 70 4572 = N0 [SYN] 549-01 (IA-5722 Lenel PTS-1640 1
35763 15.784 35763 15.784 35764 16.232 35765 16.232 35766 16.232 35769 16.232 35769 16.232 35769 16.232 35779 16.232 35779 16.232	336         1.120.0.8           311         1.200.111.9           817         1.1.90.75           817         1.1.90.42           818         1.1.90.43           818         1.1.90.31           818         1.1.90.31           818         1.1.90.33           818         1.1.238.58           818         1.1.238.58           819         1.1.238.69           819         1.1.238.36           819         1.1.238.38	1.200.111.9 1.228.0.8 1.200.0.7 1.200.0.9 1.200.0.8 1.200.0.8 1.200.0.7 1.200.0.8 1.200.0.7 1.200.0.8 1.200.0.8 1.200.0.6 1.200.0.6 1.200.0.6	RTP RTP TCP TCP TCP TCP TCP TCP TCP TCP	226 PT-TU-T 6.7.11 CPU, 55C-647252280, 5ey-5283, 226 PT-TU-T 6.7.11 CPU, 55C-646833155, 5ey-2395, 70 27210 - 80 [571] 5ey-01 (56833155, 5ey-2395, 70 27210 - 80 [571] 5ey-01 (567372) [and 1055-1640 77 27217 - 80 [571] 5ey-01 (567372) [and 1055-1640 78 5644 - 80 [571] 5ey-01 (571 [Sey-01 (571)] 5ey-01 (572) 78 5644 - 80 [571] 5ey-01 (571 [Sey-01 (571)] 5ey-01 (571) 79 5693 - 80 [571] 5ey-01 (571) 5ey-01 (571) 5ey-01 (571) 70 5727 - 80 [571] 5ey-01 (5772) [and 1055-1640 70 26722 - 80 [571] 5ey-01 (57572] [and 1055-1640 70 5632 - 80 [571] 5ey-01 (57572] [and 1055-1640
35763 15.784 35764 16.232 35766 16.232 35766 16.232 35767 16.232 35769 16.232 35769 16.232 35776 16.232 35776 16.232 35777 16.232 35777 16.232 35777 16.232	330         1.120.0.8           311         1.200.111.9           017         1.1.90.75           017         1.1.90.42           018         1.1.238.47           018         1.1.238.43           018         1.1.238.43           018         1.1.238.69           019         1.1.238.36           019         1.1.90.23           019         1.1.90.24	$\begin{array}{c} 1.200.111.9\\ 1.128.0.8\\ 1.200.0.7\\ 1.200.0.7\\ 1.200.0.9\\ 1.200.0.8\\ 1.200.0.8\\ 1.200.0.8\\ 1.200.0.8\\ 1.200.0.3\\ 1.200.0.3\\ 1.200.0.11\\ 1.200.0.11\\ 1.200.0.16\\ 1.200.0.10\\ 1.200.0.10\\ 1.200.0.10\\ 1.200.0.10\\ 1.200.0.0\\ 1.200.0.0\\ 1.200.0.0\\ 1.200.0.0\\ 1.200.0.0\\ 1.200.0.0\\ 1.200.0.0\\ 1.200.0.0\\ 1.200.0.0\\ 1.200$	RTP RTP TCP TCP TCP TCP TCP TCP TCP TCP TCP	226 FF-TUT - 6.7.11 CPU, 555-C+071522800, See-5283, 226 FF-TUT - 6.7.11 CPU, 555-C+06553155, See-2385, 77 8778 - 88 (518) See+0 Min-5722 (and R55-146) 77 8778 - 88 (518) See+0 Min-5722 (and R55-146) 78 (518) See+0 Min-1000 - 88 (518) See+0 Min-1000 - 8
35763 15.784 35764 16.232 35765 16.232 35765 16.232 35767 16.232 35776 16.232 35776 16.232 35776 16.232 35777 16.232 35777 16.232 35777 16.232 35777 16.232 35777 16.232	$\begin{array}{c} 350 & 1.126.0.3\\ 350 & 1.206.111.9\\ 351 & 1.306.75\\ 351 & 1.1.90.75\\ 351 & 1.1.90.75\\ 351 & 1.1.90.53\\ 351 & 1.1.90.31\\ 351 & 1.1.90.31\\ 351 & 1.1.90.31\\ 351 & 1.1.238.36\\ 351 & 1.1.923.36\\ 351 & 1.1.90.23\\ 351 & 1.1.90.42\\ 351 & 1.1.90.$	$\begin{array}{c} 1.200.111.9\\ 1.128.0.8\\ 1.200.0.7\\ 1.200.0.9\\ 1.200.0.9\\ 1.200.0.9\\ 1.200.0.7\\ 1.200.0.8\\ 1.200.0.7\\ 1.200.0.8\\ 1.200.0.8\\ 1.200.0.8\\ 1.200.0.8\\ 1.200.0.8\\ 1.200.0.11\\ 1.200.0.6\\ 1.200.0.11\\ 1.200.0.10\\ 1.200.0.00\\ 1.200.00\\ 1.$	RTP RTP TCP TCP TCP TCP TCP TCP TCP TCP TCP T	226 PT-TUD - 6.711 CPU, 55C-647252889, 5ee-5283, 226 PT-TUD - 6.711 CPU, 55C-646725289, 5ee-2385, 70 27710 - 80 [571] 5ee-0 kin-5772 [see-0 HS-5460 1 70 27624 - 80 [571] 5ee-0 kin-5772 [see-0 HS-5460 1 70 4585 - 80 [571] 5ee-0 kin-5772 [see-0 HS-5460 1 70 4593 - 80 [571] 5ee-0 kin-572 [see-0 HS-5460 1 70 4593 - 80 [571] 5ee-0 kin-572 [see-0 HS-5460 1 70 4593 - 80 [571] 5ee-0 kin-572 [see-0 HS-5460 1 70 4592 - 80 [571] 5ee-0 kin-572 [see-0 HS-5460 1 70 4592 - 80 [571] 5ee-0 kin-572 [see-0 HS-5460 1 70 4542 - 80 [571] 5ee-0 kin-572 [see-0 HS-5460 1 70 4542 - 80 [571] 5ee-0 kin-572 [see-0 HS-5460 1 70 4542 - 80 [571] 5ee-0 kin-572 [see-0 HS-5460 1
35763 15.784 35764 16.232 35765 16.232 35766 16.232 35766 16.232 35769 16.232 35769 16.232 35779 16.232 35777 16.232 35777 16.232 35777 16.232	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{c} 1.280.111.9\\ 1.128.0.8\\ 1.290.0.7\\ 1.290.0.7\\ 1.290.0.9\\ 1.290.0.9\\ 1.290.0.8\\ 1.290.0.8\\ 1.290.0.8\\ 1.290.0.3\\ 1.290.0.11\\ 1.290.0.11\\ 1.290.0.6\\ 1.290.0.2\\ 1.290.0.2\\ 1.290.0.2\\ 1.290.0.2\\ 1.290.0.2\\ 1.290.0.4\\ 1.290.0.2\\ 1.290.0.4\\ 1.290.0.2\\ 1.290.0.4\\ 1.290.0.2\\ 1.290.0.4\\ 1.290.0.2\\ 1.290.0.2\\ 1.290.0.2\\ 1.290.0.4\\ 1.290.0.2\\ $	RTP RTP TCP TCP TCP TCP TCP TCP TCP TCP TCP T	$\begin{array}{c} 226 \ \mbox{Tr}Tr$
35763 15.784 35764 16.232 35765 16.232 35765 16.232 35766 16.232 35769 16.232 35779 16.232 35779 16.232 35777 16.232 35777 16.232 35777 16.232 35777 16.232 35777 16.232	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	1.280.111.9 1.128.0.8 1.280.0.7 1.280.0.7 1.280.0.9 1.280.0.9 1.280.0.8 1.280.0.8 1.280.0.8 1.280.0.8 1.280.0.8 1.280.0.1 1.280.0.1 1.280.0.1 1.280.0.1 1.280.0.2 1.280.0.2	RТР TCP TCP TCP TCP TCP TCP TCP TCP TCP TCP	226 FF-TUD - 6.7.11 CPU, 555C-647352880, Seq-5280, 226 FF-TUD - 6.7.11 CPU, 555C-646735155, Seq-2385, 77 02778 - 88 (2017) Seq-0 (Lin-572) Lined RS-1468 (2017)
35763 15.784 35764 16.232 35765 16.232 35766 16.232 35766 16.232 35769 16.232 35769 16.232 35779 16.232 35777 16.232 35777 16.232 35777 16.232 35777 16.232 35777 16.232 35777 16.232	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	1.200.111.9 1.122.6.8 1.200.6.7 1.200.6.7 1.200.6.9 1.200.6.9 1.200.6.8 1.200.6.8 1.200.6.8 1.200.6.3 1.200.6.8 1.200.6.10 1.200.6.10 1.200.6.10 1.200.6.4 1.200.6.10 1.200.6.10	RTP TCP TCP TCP TCP TCP TCP TCP T	226 PT-TUD - 7.711 CPU, 557-C+77232089, 549-5280 226 PT-TUD - 7.711 CPU, 557-C+68337155, 549-2395, 70 27274 - 80 [579] 549-01 (54837155, 549-2395, 70 27274 - 80 [579] 549-01 (547572) Lend 185-51460 71 25724 - 80 [579] 549-01 (547572) Lend 185-51460 70 55724 - 80 [579] 549-01 (547572) Lend 185-51460 70 54724 - 80 [579] 549-01 (547572) Lend 185-51460 70 44454 - 80 [579] 549-01 (54752) Lend 185-51460 70 4455 - 80 [579] 549-01 [579] 540-01 [55-1460]
35763 15.784 35766 15.784 35766 16.232 35765 16.232 35767 16.232 35767 16.232 35778 16.232 35778 16.232 35777 16.232 35777 16.232 35777 16.232 35777 16.232 35777 16.232 35777 16.232 35777 16.232	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	1.280.111.9 1.128.0.8 1.280.0.7 1.280.0.7 1.280.0.9 1.280.0.9 1.280.0.9 1.280.0.5 1.280.0.5 1.280.0.8 1.280.0.6 1.280.0.6 1.280.0.6 1.280.0.4 1.280.0.4 1.280.0.4 1.280.0.4 1.280.0.5 1.280.0.5	КТР КГР ТСР ТСР ТСР ТСР ТСР ТСР ТСР ТС	226 FT-TUD - 6.711 CPU, 555-C+77152809, 5ee-5285, 226 FT-TUD - 6.711 CPU, 555-C+6853135, 5ee-2395, 226 FT-TUD - 5.711 CPU, 555-C+6853135, 5ee-2395, 217 57218 - 80 [571] Seed 81.75722 [cme8 155-5480] 218 5721 - 80 [571] Seed 81. 109 5201 - 80 [571] Seed 81. 218 5203 - 80 [571] Seed 81. 219 5212 - 80 [571] Seed 81. 219 522 [cme8 155-5480] 219 4446 - 80 [571] Seed 81. 219 4456 - 80 [571] Seed 81. 219 4456 - 80 [571] Seed 81. 219 522 [cme8 155-5480] 21 4446 - 80 [571] Seed 81. 210 572 [cme8 155-5480] 21 4446 - 80 [571] Seed 81. 210 572 [cme8 155-5480] 21 4446 - 80 [571] Seed 81. 210 572 [cme8 155-5480] 21 4446 - 80 [571] Seed 81. 21 572 [cme8 155-5480] 21 4446 - 80 [571] Seed 81. 21 572 [cme8 155-5480] 21 4446 - 80 [571] Seed 81. 21 572 [cme8 155-5480] 21 4446 - 80 [571] Seed 81. 21 572 [cme8 155-5480] 21 4446 - 80 [571] Seed 81. 21 572 [cme8 155-5480] 21 4446 - 80 [571] Seed 81. 21 572 [cme8 155-5480] 21 4446 - 80 [571] Seed 81. 21 572 [cme8 155-5480] 21 540 [571] Seed 81. 21 572 [cme8 155-5480] 21 540 [cme8 55-5480] 21 540 [cme8 55-540] 21 5
35763 15.764 35766 15.725 35766 16.222 35766 16.222 35766 16.222 35767 16.232 35767 16.232 35777 16.232	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	1.200.111.9 1.122.6.6 1.200.6.7 1.200.6.7 1.200.6.10 1.200.6.9 1.200.6.8 1.200.6.8 1.200.6.8 1.200.6.3 1.200.6.3 1.200.6.11 1.200.6.10 1.200.6.10 1.200.6.10 1.200.6.10 1.200.6.10 1.200.6.10 1.200.6.11	RTP RTP TCP TCP TCP TCP TCP TCP TCP T	226 PT-TUD - 6.711 CPU, 556-C47252280, 549-554 226 PT-TUD - 6.711 CPU, 556-C46833155, 549-2355, 70 27710 - 80 [571] Seq 04 [Grs72] Lenel 055-1460 1 70 27721 - 80 [571] Seq 04 [Grs72] Lenel 055-1460 1 70 45404 - 80 [571] Seq 04 [Grs72] Lenel 055-1460 1 70 45404 - 80 [571] Seq 04 [Grs72] Lenel 055-1460 1 70 45403 - 80 [571] Seq 04 [Grs72] Lenel 055-1460 1 70 45404 - 80 [571] Seq 04 [Grs72] Lenel 055-1460 1 70 45404 - 80 [571] Seq 04 [Grs72] Lenel 055-1460 1 70 45404 - 80 [571] Seq 04 [Grs72] Lenel 055-1460 1 70 45404 - 80 [571] Seq 04 [Grs72] Lenel 055-1460 1 70 45404 - 80 [571] Seq 04 [Grs72] Lenel 055-1460 1 70 45404 - 80 [571] Seq 04 [Grs72] Lenel 055-1460 1 70 4444 - 80 [571] Seq 04 [Grs72] Lenel 055-1460 1 70 4444 - 80 [571] Seq 04 [Grs72] Lenel 055-1460 1 70 4444 - 80 [571] Seq 04 [Grs72] Lenel 055-1460 1 70 4444 - 80 [571] Seq 04 [Grs72] Lenel 055-1460 1 70 4444 - 80 [571] Seq 04 [Grs72] Lenel 055-1460 1 70 4444 - 80 [571] Seq 04 [Grs72] Lenel 055-1460 1 70 4444 - 80 [571] Seq 04 [Grs72] Lenel 055-1460 1 70 4444 - 80 [571] Seq 04 [Grs72] Lenel 055-1460 1 70 4444 - 80 [571] Seq 04 [Grs72] Lenel 055-1460 1 70 4444 - 80 [571] Seq 04 [Grs72] Lenel 055-1460 1 70 4444 - 80 [571] Seq 04 [Grs72] Lenel 055-1460 1 70 4444 - 80 [571] Seq 04 [Grs72] Lenel 055-1460 1 70 4445 - 80 [571] Seq 04 [Grs72] Lenel 055-1460 1 70 4444 - 80 [571] Seq 04 [Grs72] Lenel 055-1460 1 70 4445 - 80 [571] Seq 04 [Grs72] Lenel 055-1460 1 70 4445 - 80 [571] Seq 04 [Grs72] Lenel 055-1460 1 70 4445 - 80 [571] Seq 04 [Grs72] Lenel 055-1460 1 70 4445 - 80 [571] Seq 04 [Grs72] Lenel 055-1460 1 70 445 - 80 [571] Seq 04 [Grs72] Lenel 055-1460 1 70 445 - 80 [571] Seq 04 [Grs72] Lenel 055-1460 1 70 445 - 80 [571] Seq 04 [Grs72] Lenel 055-1460 1 70 445 - 80 [571] Seq 04 [Grs72] Lenel 055-1460 1 70 445 - 80 [571] Seq 04 [Grs72] Lenel 055-1460 1 70 445 - 80 [571] Seq 04 [Grs72] Lenel 055-1460 1 70 445 - 80 [571] Seq 04 [Grs72] Lenel 055-1460 1 70 445 - 80 [571] Seq 045 [Grs72] Lenel 055-1460 1 70 [Grs72] Lenel 055
35763 13.744 35764 16.222 35765 16.722 35765 16.722 35767 16.722 35767 16.722 35777 16.723 35777 16.723 357777 16.723 357777 16.723 35777 16.723 35777 16.723 35777 16.723 35777 16.723 35777 16.723 357	330         1.1263.0.8           1.1263.0.8         1.1.90.75           917         1.1.90.75           917         1.1.90.75           917         1.1.90.75           918         1.1.230.47           918         1.1.233.50           919         1.1.90.64           911         1.1.935.56           911         1.1.936.59           911         1.1.90.64           911         1.1.936.58           913         1.1.236.59           914         1.1.236.50           915         1.1.236.69           914         1.1.90.64           915         1.1.22.139           915         1.1.52.18           916         1.1.52.18           917         1.1.43.65           918         1.1.32.91           919         1.1.43.20           911         1.1.32.91           912         1.1.159.133           913         1.1.43.196           914         1.1.91.91.95	1.280.111.9 1.128.0.8 1.280.0.7 1.280.0.10 1.280.0.9 1.280.0.9 1.280.0.8 1.280.0.8 1.280.0.8 1.280.0.8 1.280.0.8 1.280.0.8 1.280.0.4 1.280.0.	ВТР ТСР ТСР ТСР ТСР ТСР ТСР ТСР Т	226 FF-TUD - 6.711 CPU, 555C-647322800, 5ee-5283, 720 5778 - 100 (595) 5ee-6053155, 5ee-2395, 720 5778 - 100 (595) 5ee-00 467-5720 (see-00 55-1460 1 720 5787 - 100 (597) 5ee-00 467-5720 (see-00 55-1460 1 720 55454 - 100 (597) 5ee-00 467-5720 (see-00 55-1460 1 720 55454 - 100 (597) 5ee-00 467-5720 (see-00 55-1460 1 720 5727 - 100 (597) 5ee-00 467-5720 (see-00 55-1460 1 720 5727 - 100 (597) 5ee-00 467-5720 (see-00 55-1460 1 720 5727 - 100 (597) 5ee-00 467-5720 (see-00 55-1460 1 720 5727 - 100 (597) 5ee-00 467-5720 (see-00 55-1460 1 720 5425 - 100 (597) 5ee-00 467-5720 (see-00 55-1460 1 720 4454 - 100 (597) 5ee-00 467-5720 (see-00 55-1460 1 720 4445 - 100 (597) 5ee-00 467-5720 (see-00 55-1460 1 720 4445 - 100 (597) 5ee-00 467-5720 (see-00 55-1460 1 720 4445 - 100 (597) 5ee-00 467-5720 (see-00 55-1460 1 720 4445 - 100 (597) 5ee-00 467-5720 (see-00 55-1460 1 720 4445 - 100 (597) 5ee-00 467-5720 (see-00 55-1460 1 720 4445 - 100 (597) 5ee-00 467-5720 (see-00 55-1460 1 720 4445 - 100 (597) 5ee-00 467-5720 (see-00 55-1460 1 720 4445 - 100 (597) 5ee-00 467-5720 (see-00 55-1460 1 720 4445 - 100 (597) 5ee-00 467-5720 (see-00 55-1460 1 720 4445 - 100 (597) 5ee-00 467-5720 (see-00 55-1460 1 720 4445 - 100 (597) 5ee-00 467-5720 (see-00 55-1460 1 720 4445 - 100 (597) 5ee-00 467-5720 (see-00 55-1460 1 720 4445 - 100 (597) 5ee-00 467-5720 (see-00 55-1460 1 720 4445 - 100 (597) 5ee-00 467-5720 (see-00 55-1460 1 720 4445 - 100 (597) 5ee-00 467-5720 (see-00 55-1460 1 720 4445 - 100 (597) 5ee-00 467-5720 (see-00 55-1460 1 720 4445 - 100 (597) 5ee-00 467-5720 (see-00 55-1460 1 720 4445 - 100 (597) 5ee-00 467-5720 (see-00 55-1460 1 720 4445 - 100 (597) 5ee-00 467-5720 (see-00 55-1460 1 720 4465 - 100 (597) 5ee-00 467-5720 (see-00 55-1460 1 720 4465 - 100 (597) 5ee-00 467-5720 (see-00 55-1460 1 720 4465 - 100 (597) 5ee-00 467-5720 (see-00 55-1460 1 720 4465 - 100 (597) 5ee-00 467-5720 (see-00 55-1460 1 720 597) 5ee-00 5670 (see-00 567720 (see-00 55-1460 1) 720 567 - 100 (see-00 567720 (see-00 5770 (see-00 5770 (see-00 5770 (see-00 5770
3766 15.744 35766 15.724 35766 16.22 35765 16.22 35766 16.22 35766 16.22 35766 16.22 35776 16.22 35777 16.22 35778 16.22 35778 16.22 35778 16.22 35778 16.22 35778 16.22 3578 16.22 3577 16.	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	1.288.111.9 1.128.6.8 1.289.6.7 1.289.6.7 1.289.6.7 1.289.6.19 1.280.6.19 1.280.6.19 1.280.6.8 1.280.6.0.7 1.280.6.0.8 1.280.6.0.11 1.280.6.19 1.280.6.19 1.286.6.19 1.286.6.11 1.286.6.12 1.286.6.11 1.286.6.11 1.286.6.12 1.286.6.11 1.286.6.11 1.286.6.12 1.286.6.11 1.286.6.12 1.286.6.11 1.286.6.11 1.286.6.12 1.286.6.11 1.286.6.12 1.286.6.11 1.286.6.12 1.286.6.11 1.286.6.12 1.286.6.11 1.286.6.12 1.286.6.11 1.286.6.12 1.286.6.11 1.286.6.12 1.286.6.11 1.286.6.12 1.286.6.12 1.286.6.12 1.286.6.12 1.286.6.12 1.286.6.12 1.286.6.12 1.286.6.12 1.286.6.5 1.286.6.5 1.286.5 1.286.5 1.286.5 1.286.5 1.286.5 1.286.5 1.286.5 1.286.5 1.286.5 1.286.5 1.286.5 1.285.5	417 477 477 477 477 477 477 477 477 477	226 FF-1TU-F, 7.11 CPU, 555-C+97.152808, 5ee-5283, 226 FF-1TU-F, 7.11 CPU, 555-C+68531155, 5ee-2395, 226 FF-1TU-F, 7.11 CPU, 555-C+68531155, 5ee-2395, 226 FF-1TU-F, 7.11 CPU, 555-C+6851155, 226 FF-150, 226 FF-1
5761 15.704 37676 16.323 37676 16.323 37676 16.323 376776 16.323 37677 16.323 37677 16.323 37577 16.3257777 1	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	1.288.111.9 1.128.0,67 1.280.0,7 1.280.0,7 1.280.0,9 1.280.0,9 1.280.0,9 1.280.0,9 1.280.0,7 1.280.0,8 1.280.0,8 1.280.0,8 1.280.0,8 1.280.0,4 1.280.0,4 1.280.0,4 1.280.0,3 1.280.0,5 1.280.0,	8179 TCP TCP TCP TCP TCP TCP TCP TCP	$ \begin{array}{c} 26 \ \mbox{Pirture} 1, 0, 11 \ \mbox$
5779 15.787 5779 15.787 5779 16.222 5776 16.222 5776 16.222 5776 16.222 5776 16.222 5776 16.222 5777 16.222 5778	1,128,0,1         1,128,0,1           1,128,0,1         1,128,0,1           017         1,1,20,0,2           017         1,1,20,0,2           017         1,1,20,0,2           018         1,1,20,0,1           018         1,1,20,0,1           018         1,1,20,0,1           018         1,1,20,0,1           018         1,1,23,16           019         1,1,20,0,1           019         1,1,20,0,1           019         1,1,20,0,1           019         1,1,40,1           019         1,1,42,13           019         1,1,42,13           019         1,1,42,13           019         1,1,42,13           019         1,1,42,13           019         1,1,43,120           010         1,1,152,18           011         1,1,130,135           012         1,1,44,130           012         1,1,44,140	1.288,111.9 1.128,6,6 1.220,6,7 1.220,0,9 1.220,0,9 1.220,0,9 1.220,0,9 1.220,0,9 1.220,0,9 1.220,0,9 1.220,0,9 1.220,0,0,0 1.220,0,0,0 1.220,0,0,0 1.220,0,0,0 1.220,0,0,0,0 1.220,0,0,0,0 1.220,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0	ятр тср тср тср тср тср тср тср тср тср т	$ \begin{array}{c} 226 \ \mbox{T-TU-T} & - 7.11 \ \mbox{CV} & 555C-407322400 \ \mbox{Seq} & 588-2365, \\ 226 \ \mbox{T-U-T} & - 101 \ \mbox{CV} & 587-240 \ \mbox{Seq} & 588-2365, \\ 226 \ \mbox{T-U-T} & - 101 \ \mbox{CV} & 588-2365, \\ 217 \ \mbox{Seq} & - 101 \ \mbox{Seq} &$
35763 15.780 35766 16.222 35766 16.223 35766 16.223 35766 16.223 35766 16.223 35767 16.232 35777 16.232 35778 16.232 35778 16.232 35787 16.232 35787 16.232	1         1.4.260         5.10           1         1.4.260         5.10           1         1.4.260         5.10           1         1.4.260         5.10           11         1.90         5.0           1017         1.1.90         5.11           1018         1.1.284         47           1018         1.1.284         47           1018         1.1.284         5.00           1019         1.1.284         5.00           1019         1.1.224         5.00           11         1.234         5.00           11         1.234         5.00           11         1.41         5.00           11         1.42         5.00           11         1.42         5.00           11         1.41         5.00           11         1.41         5.00           11         1.41         1.159           11         1.1.41         1.159           11         1.1.44         1.144	$\begin{array}{c} 1,288,111,9\\ 1,288,0,0,7\\ 1,280,0,7\\ 1,280,0,9\\ 1,280,0,9\\ 1,280,0,9\\ 1,280,0,9\\ 1,280,0,9\\ 1,280,0,9\\ 1,280,0,0\\ $	TR           TCP	226 FF-1TU-1 6.7.11 CPU, 556-C+7732280 Seq-2363, 226 FF-1TU-1 7, 271 CPU, 556-C+67325280 Seq-2363, 226 FF-1TU-1 7, 271 CPU, 556-C+66353145, 586-2363, 226 FF-1TU-1 7, 271 CPU, 556-C+66353145, 586-2363, 226 FF-1TU-1 7, 271 CPU, 571 CPU, 572 CPU, 574 CPU, 574 CPU, 572 CPU, 572 CPU, 574 CPU, 57
5774 15.787 5775 15.787 5777 16.722 5776 16.722 5776 16.722 5776 16.722 5776 16.722 5776 16.722 5777 16.722 5778 16.722 5778 16.322 5778 16.322 5788 16.325 5788	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{c} 1.369, 111.9\\ 1.125, 0.47\\ 1.225, 0.47\\ 1.225, 0.47\\ 1.226, 0.59\\ 1.200, 0.59\\ 1.200, 0.59\\ 1.200, 0.5, 0.57\\ 1.2$	RTP           TCP	226 PT-TUD - 6.711 CPU, 555C-467252280, 5ee-5283, 228 PT-TUD - 6.711 CPU, 555C-46833155, 5ee-2385, 228 PT-TUD - 515-1669 T1 - 5172 (cm-0 PT-51-669 T1 - 5172) (cm-0 PT-51-669 T1 - 5126) (cm-0 PT-51-669 T1 - 5126
5774 15. 787 5776 16. 232 5776 16. 232 5776 16. 232 5776 16. 232 5776 16. 322 5776 16. 322 5777 16. 322 5777 16. 322 5777 16. 322 5777 16. 323 5777 16. 323 5778 16. 325 5778 16. 325 57	139         1. 2.80, 11, 9           11.19, 130, 75           11.19, 14, 19, 75           11.12, 19, 14, 19, 15           11.12, 19, 14, 19, 13           11.1, 19, 14, 19, 13           11.1, 19, 14, 19, 13           11.1, 19, 14, 19, 13           11.1, 19, 14, 19, 13           11.1, 19, 14, 19, 13           11.1, 12, 18, 16           11.1, 12, 18, 16           11.1, 12, 14, 19, 13           11.1, 12, 14, 19, 13           11.1, 12, 14, 19, 13           11.1, 12, 14, 19, 13           11.1, 12, 14, 19, 13           11.1, 14, 12, 19           11.1, 14, 12, 19           11.1, 14, 13, 19           11.1, 14, 13, 19           11.1, 14, 13, 19           11.1, 14, 14, 14           11.1, 14, 14, 14           11.1, 14, 14, 14           11.1, 14, 14, 14           11.1, 14, 14, 14           11.1, 14, 14, 14           11.1, 14, 14, 14           11.1, 14, 14, 14           11.1, 14, 14, 14           11.1, 14, 14, 14           11.1, 14, 14, 14           11.1, 14, 14, 14           11.1, 14, 14, 14           11.1, 14, 14, 14           11.1, 14, 14, 14	$\begin{array}{c} 1.369, 111.9\\ 1.122, 63, 71\\ 1.220, 6, 19\\ 1.223, 64, 7\\ 1.200, 6, 19\\ 1.200, 6, 19\\ 1.200, 6, 9\\ 1.200, 6, 9\\ 1.200, 6, 9\\ 1.200, 6, 10\\ 1.200, 10\\ 1.20$	ятя чтр тср тср тср тср тср тср тср тср тср т	226 FF-1TU-F 6.711 CPU, 555-C+7215280 See-5285, 226 FF-1TU-F 6.711 CPU, 555-C+6853135, 58e-5285, 226 FF-1TU-F 6.711 CPU, 555-C+6853135, 58e-7285, 216 See-2055, 216 See
<ul> <li>5774 15. 787</li> <li>5774 15. 787</li> <li>5776 16. 722</li> <li>5776 16. 722</li> <li>5776 16. 522</li> <li>5776 16. 522</li> <li>5776 16. 523</li> <li>5776 16. 523</li> <li>5777 16. 723</li> <li>5778 16. 723</li> </ul>	11         1.1.500.5.1           11.1.500.5.1         1.1.500.5.1           11.1.500.5.1         1.1.500.5.1           11.1.500.5.1         1.1.238.47           11.1.501.5         1.1.238.47           11.1.501.5         1.1.238.47           11.1.238.47         1.1.238.47           11.1.238.49         1.1.238.49           11.1.238.49         1.1.238.49           11.1.238.49         1.1.238.49           11.1.238.49         1.1.238.49           11.1.238.49         1.1.428.49           11.1.238.49         1.1.428.49           11.1.41.50         1.1.42.19           11.1.41.41         1.1.42.19           11.1.41.41         1.1.42.19           11.1.41.41         1.1.42.19           11.1.41.41         1.1.42.19           11.1.41.41         1.1.44.419           11.1.41.41         1.1.44.419           11.1.41.41         1.1.42.419           11.1.41.41         1.1.42.419           11.1.41.41         1.1.42.419           11.1.41.41         1.1.42.419           11.1.41.41         1.1.44.419           11.1.41.41.41         1.1.44.419           11.1.41.41.419         1.1.44.419	$\begin{array}{c} 1.369, 111.9\\ 1.269, 0.57\\ 1.2200, 0.7\\ 1.200, 0.7\\ 1.200, 0.7\\ 1.200, 0.8\\ 1.200, $	TR           TCP	$ \begin{array}{c} 26 \ \mbox{f} -1710 \ \mbox{f} -5.711 \ $
<ul> <li>5574 15. 2013</li> <li>5574 15. 2013</li> <li>5576 15. 222</li> <li>5576 16. 322</li> <li>5576 16. 322</li> <li>5576 16. 323</li> <li>5577 16. 323</li> <li>5578 16. 323</li> <li>557</li></ul>	101         1.1.00.11           11.00.7         1.1.00.75           11.1.00.75         101.7           11.1.00.42         1.1.00.75           11.1.00.42         1.1.00.75           11.1.00.42         1.1.00.75           11.1.00.43         1.1.00.31           11.1.01.01         1.1.02.34           11.1.02.34         1.1.00.31           11.1.02.34         1.1.02.34           11.1.02.34         1.1.00.44           11.1.02.34         1.1.00.44           11.1.02.34         1.1.00.44           11.1.1.02.34         1.1.1.02.34           11.1.1.1.1.34         1.1.1.22.34           11.1.1.1.1.1.23         1.1.1.1.23.20           11.1.1.1.1.1.1.24         1.1.1.1.24           11.1.1.1.1.1.1.23         1.1.1.1.23.20           11.1.1.1.1.1.23         1.1.4.1.40           11.1.1.1.1.1.1.23         1.1.4.1.40           11.1.1.1.1.1.1.23         1.1.4.1.40           11.1.1.4.1.42         1.1.4.1.40           11.1.4.1.4.1.40         1.1.4.1.40           11.1.4.1.4.1.40         1.1.4.1.40           11.1.4.1.4.1.40         1.1.4.1.40           11.1.4.1.40.00.7         1.1.4.1.40           11.1.4.1.40.00.7	$\begin{array}{c} 1.369, 111.9\\ 1.122, 51, 62\\ 1.122, 51, 62\\ 1.122, 51, 62\\ 1.220, 63, 10\\ 1.220, 63, 93\\ 1.220, 63, 93\\ 1.220, 63, 93\\ 1.220, 63, 93\\ 1.220, 63, 10\\ 1.220, 64$	418           471	$ \begin{array}{c} 226 \ \mbox{T-TU-T} & - 0.711 \ \mbox{CU} & \mbox{SSC-0-72} 12-000 \ \mbox{Seq} & $
<ul> <li>5774 15. 787</li> <li>5776 15. 792</li> <li>5776 16. 222</li> <li>5776 16. 222</li> <li>5776 16. 222</li> <li>5776 16. 322</li> <li>5776 16. 322</li> <li>5776 16. 322</li> <li>5776 16. 322</li> <li>5777 16. 322</li> <li>5778 16. 322</li> <li>5788 16. 322</li> <li>5788 16. 322</li> </ul>	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{c} 1.389, 111.9\\ 1.120, 0.6, 7\\ 1.220, 0.7\\ 1.200, 0.7\\ 1.200, 0.7\\ 1.200, 0.8\\ 1.200, 0.9\\ 1.200, 0.9\\ 1.200, 0.9\\ 1.200, 0.8\\ 1.200, 0.6\\ 1.200,$	418           477           401	226 FF-1TU-F, 7.11 PU, 555-C+7.152808, 5ee-5285, 70 8778 - 80 (51) 5ee-615155, 5ee-7285, 70 8778 - 80 (51) 5ee-785, 70 8788 - 80 (51) 5ee-788, 70 572 (51) 5ee-
<ul> <li>5574 15. 201</li> <li>5574 15. 202</li> <li>5576 16. 222</li> <li>5576 16. 223</li> <li>5576 16. 223</li> <li>5576 16. 323</li> <li>5576 16. 323</li> <li>5576 16. 323</li> <li>5577 16. 323</li> <li>55777 16. 323</li> <li>55778 16. 322</li> <li>55778 16. 323</li> <li>55778 16. 323</li> <li>5578 16. 323</li> </ul>	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{c} 1.369, 111.9\\ 1.269, 6.7\\ 1.269, 6.7\\ 1.269, 6.7\\ 1.269, 6.7\\ 1.269, 6.8\\ 1.269, 6.$	418 419 401 401 401 401 401 401 401 401 401 401	$\begin{array}{c} 26 \ \mbox{f} -1710 \ \mbox{f} -1711 \ \mbox{f} -1$
<ul> <li>55761 15. 202</li> <li>55763 15. 202</li> <li>55765 15. 202</li> <li>55765 15. 202</li> <li>55765 16. 322</li> <li>55767 16. 322</li> <li>55777 16. 322</li> <li>55778 16. 322</li> <li>55786 16. 322</li> <li>55786 15. 322</li> <li>55786 15. 322</li> <li>55786 15. 322</li> <li>55786 15. 323</li> <li>55786 16. 323</li> <li>55786 16. 323</li> <li>55786 15. 323</li> <li>55786 16. 323</li> <li>55786 16. 323</li> <li>55786 16. 323</li> <li>55786 16. 323</li> <li>55786 15. 324</li> <li>55787 16. 324</li> <li>55787 16. 323</li> <li>55787 16</li></ul>	191         1. 200, 11, 90, 75           11. 190, 12         11. 190, 75           1017         1. 1. 90, 75           1017         1. 1. 90, 75           1017         1. 1. 90, 73           11. 1, 201, 47         101, 90, 73           11. 1, 201, 60         11, 201, 60           11. 1, 201, 61         11, 1, 201, 61           11. 1, 201, 61         11, 1, 201, 61           11. 1, 201, 61         11, 1, 40, 13           11. 1, 40, 13         11, 40, 13           11. 1, 40, 13         11, 40, 140           11. 1, 41, 120         11, 41, 140, 130           11. 1, 41, 140, 140         11, 41, 140, 140           11. 1, 41, 140, 140         11, 41, 140, 140           11. 1, 141, 141, 141, 141, 141, 141, 141	$\begin{array}{c} 1.369, 111.9\\ 1.122, 63, 67\\ 1.122, 63, 67\\ 1.220, 6, 10\\ 1.200, 6, 10\\ 1.200, 6, 10\\ 1.200, 6, 0, 9\\ 1.200, 6, 0, 0\\ 1.200, 6, 0\\ 1.200, $	413           471	226 FF-110-F 0.711 CPU, 555-C+7252808, 5ee-5285, 226 FF-110-F 0.711 CPU, 555-C+67525280, 5ee-2385, 226 FF-110-F 0.711 CPU, 555-C+6853135, 5ee-2385, 226 FF-110-F 0.711 CPU, 555-C+6853135, 5ee-2385, 226 FF-110-F 0.711 CPU, 555-C+67521 Lenet F55-2480 F 226 FF-100-F 0.701 Sep-0 H LOCCSYN 70 5434 = 0 [571] Sep-0 H LOCCSYN 70 5433 = 0 [571] Sep-0 H LOCS721 Lenet F55-1460 F 70 5432 = 0 [571] Sep-0 H LOCS722 Lenet F55-1460 F 70 4834 = 0 [571] Sep-0 H LOCS722 Lenet F55-1460 F 70 4834 = 0 [571] Sep-0 H LOC722 Lenet F55-1460 F 70 484 = 2760 [571, AC2] Sep-0 H Act-1 H LOC722 Lenet F55-1460 F 70 48 = 2760 [571, AC2] Sep-0 H Act-1 H LOC722 Lenet F55-1460 F 70 48 = 2760 [571, AC2] Sep-0 H Act-1 H LOC722 Lenet
<ul> <li>5574: 15. 200</li> <li>5574: 15. 200</li> <li>5576: 16. 222</li> <li>5576: 16. 222</li> <li>5576: 16. 222</li> <li>55776: 16. 222</li> <li>55777</li> <li>16. 222</li> <li>55777</li> <li>16. 222</li> <li>55777</li> <li>16. 222</li> <li>55777</li> <li>16. 222</li> <li>55778</li> <li>16. 222</li> <li>55778</li> <li>16. 222</li> <li>5578</li> <li>16. 232</li> <li>5578</li> <li>16. 242</li> <li>5578</li> <li>16. 242</li> <li>5578</li> <li>16. 242</li></ul>	191         1. 200, 11, 90, 75           11, 190, 75         11, 190, 75           11, 190, 75         11, 190, 75           11, 190, 73         11, 190, 73           11, 190, 74         11, 190, 73           11, 190, 74         11, 190, 73           11, 190, 13         11, 190, 73           11, 191, 191         11, 123, 191           11, 191, 191         11, 192, 131           11, 191, 191         11, 194, 131           11, 140, 143         11, 140, 143           11, 141, 142, 120         11, 144, 120           11, 1, 159, 135         11, 144, 145           11, 1, 159, 135         11, 144, 144           11, 144, 145         11, 144, 145           11, 144, 145         11, 144, 145           11, 144, 145         11, 144, 145           11, 144, 145         11, 144, 145           11, 144, 145         11, 144, 145           11, 144, 145         11, 144, 145           11, 144, 145         11, 144, 145           11, 144, 145         11, 144, 145           11, 144, 145         11, 144           11, 144         11, 144           11, 144         11, 144           11, 144         11, 144           11, 144,	$\begin{array}{c} 1.369, 111.9\\ 1.260, 0.17\\ 1.200, 0.7\\ 1.200, 0.7\\ 1.200, 0.9\\ 1.200, 0.9\\ 1.200, 0.9\\ 1.200, 0.9\\ 1.200, 0.8\\ 1.200, 0$	417 477 477 477 477 477 477 477 477 477	226         77-1110-16         7.11         7000         555-640           226         77-110         7000         556-640         700         700           226         77-110         7000         556-640         7000         700         700         70
<ul> <li>S778 15, 287</li> <li>S778 15, 287</li> <li>S778 16, 232</li> <li>S776 16, 232</li> <li>S776 16, 232</li> <li>S776 16, 232</li> <li>S777 16, 232</li> <li>S778 16, 232</li> <li>S777 16, 232</li> <li>S778 16, 232</li> <li>S778</li></ul>	139         1. 2.308, 11, 99, 73           1. 1. 99, 73         1. 1. 99, 73           1. 1. 1. 99, 73         1. 1. 99, 73           1. 1. 1. 99, 73         1. 1. 99, 73           1. 1. 1. 99, 73         1. 1. 99, 73           1. 1. 1. 99, 73         1. 1. 99, 73           1. 1. 1. 99, 73         1. 1. 99, 73           1. 1. 1. 99, 73         1. 1. 29, 73           1. 1. 1. 99, 73         1. 1. 29, 73           1. 1. 1. 91, 13         1. 1. 23, 19           1. 1. 1. 29, 14         1. 1. 23, 19           1. 1. 1. 90, 14         1. 1. 42, 139           1. 1. 1. 90, 14         1. 1. 1. 12, 11           1. 1. 1. 91, 15         1. 1. 1. 12, 11           1. 1. 1. 12, 11         1. 1. 12, 11           1. 1. 1. 12, 11         1. 1. 1. 12, 11           1. 1. 1. 12, 11         1. 1. 1. 12, 11           1. 1. 1. 12, 11         1. 1. 1. 12, 13           1. 1. 1. 12, 13         1. 1. 1. 12, 13           1. 1. 1. 12, 13         1. 1. 1. 12, 14           1. 1. 1. 12, 14         1. 1. 1. 12, 14           1. 1. 1. 12, 14         1. 1. 12, 14           1. 1. 1. 12, 14         1. 1. 12, 14           1. 1. 1. 12, 14         1. 1. 12, 14           1. 1. 1. 12, 14         1. 1	$\begin{array}{c} 1.369, 111.9\\ 1.260, 6.7\\ 1.260, 6.7\\ 1.200, 6.10\\ 1.200, 6.9\\ 1.200, 6.9\\ 1.200, 6.9\\ 1.200, 6.9\\ 1.200, 6.9\\ 1.200, 6.9\\ 1.200, 6.3\\ 1.200, 6.3\\ 1.200, 6.3\\ 1.200, 6.4\\ 1.200, 6.5\\ 1.200, 6$	413           471	$ \begin{array}{c} 226 \ \mbox{Tr}T$
<ul> <li>5574: 15. 789</li> <li>5574: 15. 789</li> <li>5576: 16. 322</li> <li>5576: 16. 323</li> <li>5576: 16. 323</li> <li>5577: 16. 323</li> <li>5578: 16. 323</li> <li>5579: 16</li></ul>	191         1. 200, 11, 90, 75           11, 190, 12         11, 190, 75           11, 190, 12         11, 190, 12           11, 190, 12         11, 190, 12           11, 190, 12         11, 190, 12           11, 190, 12         11, 190, 13           11, 190, 13         11, 190, 13           11, 190, 13         11, 190, 13           11, 190, 13         11, 190, 13           11, 190, 13         11, 190, 13           11, 1, 190, 13         11, 190, 13           11, 1, 190, 13         11, 190, 13           11, 1, 190, 13         11, 190, 13           11, 1, 190, 13         11, 11, 190, 13           11, 1, 190, 13         11, 11, 190, 13           11, 11, 190, 13         11, 11, 190, 13           11, 11, 190, 13         11, 11, 190, 13           11, 11, 190, 13         11, 11, 190, 13           11, 11, 11, 11, 11, 11, 11, 11, 11, 11,	$\begin{array}{c} 1.369, 111.9\\ 1.122, 63, 71\\ 1.220, 6, 19\\ 1.223, 64, 7\\ 1.220, 6, 10\\ 1.200, 6, 10\\ 1.200, 6, 9\\ 1.200, 6, 9\\ 1.200, 6, 9\\ 1.200, 6, 11\\ 1.200, 6, 6\\ 1.200, 6, 11\\ 1.200, 6, 6\\ 1.200, 6, 10\\$	417 477 477 477 477 477 477 477 477 477	$ \begin{array}{c} 226 \ \mbox{T-TU-T} & - \ \mbox{T-1} & - \ $
<ul> <li>5574: 15. 798</li> <li>5574: 15. 798</li> <li>5576: 15. 322</li> <li>5576: 16. 322</li> <li>5576: 16. 323</li> <li>55777: 16. 323</li> <li>55787: 16. 323</li> <li>55797: 16. 323</li></ul>	199         1. 200, 11, 99, 75           11. 199, 75         11. 199, 75           11. 199, 75         11. 199, 73           11. 199, 74         11. 199, 74           11. 199, 74         11. 199, 74           11. 199, 74         11. 199, 74           11. 199, 74         11. 199, 73           11. 199, 131         11. 199, 131           11. 199, 131         11. 123, 69           11. 199, 131         11. 199, 131           11. 199, 131         11. 42, 139           11. 199, 131         11. 42, 139           11. 14, 12, 139         11. 142, 139           11. 14, 14, 12, 139         11. 144, 120           11. 1. 159, 135         11. 144, 149           122         1. 200, 0, 10           122         1. 200, 0, 10           122         1. 200, 0, 10           122         1. 200, 0, 10           122         1. 200, 0, 10           122         1. 200, 0, 10           122         1. 200, 0, 10           122         1. 200, 0, 10           122         1. 200, 0, 10           123         1. 200, 0, 10           123         1. 200, 0, 10           123         1. 200, 0, 10	$\begin{array}{c} 1.369, 111.9\\ 1.260, 6.17\\ 1.200, 6.7\\ 1.200, 6.7\\ 1.200, 6.7\\ 1.200, 6.9\\ 1.200, 6.9\\ 1.200, 6.9\\ 1.200, 6.9\\ 1.200, 6.7\\ 1.200, 6.8\\ 1.200, 6.7\\ 1.200, 6.8\\ 1.200, 6.9\\ 1.200, 6$	918           917           928           929	226 FF-1TU-1 6.7.11 CPU, 556-C+7252880, See-5280, 226 FF-1TU-1 7.71 CPU, 556-C+725280, See-2380, 270 2770 4.80 (371 324, 564 4.87272) Lenet 855-2460 170 2771 4.80 (371 3544) 4.80 (371 372 144) 4.80 (371 372 144) 4.80 (371 372 144) 4.80 (371 372 144) 4.80 (371 372 144) 4.80 (371 372 144) 4.80 (371 372 144) 4.80 (371 372 144) 4.80 (371 372 144) 4.80 (371 372 144) 4.80 (371 372 144) 4.80 (371 372 144) 4.80 (371 372 144) 4.80 (371 372 144) 4.80 (371 372 144) 4.80 (371 372 144) 4.80 (371 374 4.40 (371 3544) 4.80 (371 372 144) 4.80 (371 374 4.40 (371 3544) 4.80 (371 372 144) 4.80 (371 374 144) 4.80 (371 372 144) 4.80 (371 374 144) 4.80 (371 374 144) 4.
<ul> <li>S778 15. 2013</li> <li>S778 15. 2013</li> <li>S778 15. 2013</li> <li>S778 16. 212</li> <li>S776 16. 212</li> <li>S776 16. 212</li> <li>S777 16. 212</li> <li>S778 16. 223</li> <li>S779 16. 223</li> </ul>	No.         L. 200, 11, 09, 73           1.1, 190, 42         1.1, 190, 42           1.1, 190, 42         1.1, 190, 42           1.1, 190, 42         1.1, 190, 42           1.1, 190, 42         1.1, 190, 42           1.1, 190, 42         1.1, 190, 42           1.1, 190, 13         1.1, 190, 13           1.1, 190, 13         1.1, 190, 13           1.1, 190, 13         1.1, 123, 190           1.1, 123, 191         1.1, 123, 191           1.1, 190, 13         1.1, 190, 135           1.1, 190, 135         1.1, 191, 135           1.1, 143, 143         1.1, 143, 143           1.1, 143, 143         1.1, 143, 143           1.1, 143, 144         1.1, 143, 145           1.1, 143, 145         1.1, 143, 145           1.1, 143, 145         1.1, 143, 145           1.1, 143, 145         1.1, 143, 145           1.1, 144, 145         1.1, 143, 145           1.1, 143, 145         1.1, 143, 145           1.1, 144, 145         1.1, 143, 145           1.1, 144, 145         1.1, 144, 145           1.1, 144, 145         1.1, 143, 145           1.1, 144, 145         1.1, 143, 145           1.1, 144, 145         1.1, 144, 145           1.1, 144, 145	$\begin{array}{c} 1.369, 111.9\\ 1.260, 6.7\\ 1.260, 6.7\\ 1.200, 6.10\\ 1.200, 6.9\\ 1.200, 6$	413         413           473         437           473         437           473         437           473         437           473         437           473         437           473         437           473         437           473         437           474         437           475         437           473         437           473         437           473         437           473         437           473         437           473         437           473         437           473         437           473         437           473         437	$ \begin{array}{c} 226 \ \mbox{TI-TL} D-1.1 \ \mbox{CU} \ \ \mbox{SST-C-P122200} \ \ \mbox{SST-C-P122200} \ \ \mbox{SST-C-P122200} \ \ \mbox{SST-C-P12200} \ \ \mbox{SST-C-P1200} \ \ \mbox{ST-C-P1200} \ \ \ \ \ \mbox{ST-C-P1200} \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ $
<ul> <li>5574: 15. 798</li> <li>5574: 15. 798</li> <li>5574: 15. 798</li> <li>5576: 16. 232</li> <li>5576: 16. 323</li> <li>5576: 16. 323</li> <li>5577: 16. 323</li> <li>55779: 16. 323</li> <li>55789: 16. 323</li> <li>55799: 16. 323</li> </ul>	191         1. 200, 11, 90, 75           11, 190, 12         11, 190, 75           11, 190, 12         11, 190, 12           11, 190, 12         11, 190, 12           11, 190, 12         11, 190, 12           11, 190, 12         11, 190, 12           11, 190, 12         11, 190, 13           11, 190, 13         11, 190, 13           11, 190, 13         11, 190, 13           11, 1, 190, 13         11, 190, 13           11, 1, 190, 13         11, 140, 160           11, 1, 190, 13         11, 140, 160           11, 1, 141, 150, 150         11, 141, 150, 150           11, 1, 141, 150, 150         11, 141, 150, 150           11, 1, 141, 140         11, 141, 140           11, 141, 140, 140         1, 1150, 150           11, 141, 140, 140         1, 1150, 150           11, 141, 140, 140         1, 1150, 150           11, 141, 140, 140         1, 1150, 150           11, 141, 140, 140         1, 1150, 150           11, 141, 140, 140         1, 1150, 150           11, 141, 140, 140         1, 1150, 150           11, 141, 140, 140         1, 1150, 150           11, 141, 140, 140         1, 1150, 150           11, 140, 140         1, 1100, 40, 70 <t< th=""><th><math display="block">\begin{array}{c} 1.386, 111.9\\ 1.120, 60, 111.9\\ 1.120, 60, 71\\ 1.200, 61, 90\\ 1.200, 61, 90\\ 1.200, 61, 90\\ 1.200, 61, 91\\ 1.200, 91\\ 1.</math></th><th>413         413           473         437</th><th><math display="block"> \begin{array}{c} 226 \ \mbox{T-III} \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \</math></th></t<>	$\begin{array}{c} 1.386, 111.9\\ 1.120, 60, 111.9\\ 1.120, 60, 71\\ 1.200, 61, 90\\ 1.200, 61, 90\\ 1.200, 61, 90\\ 1.200, 61, 91\\ 1.200, 91\\ 1.$	413         413           473         437	$ \begin{array}{c} 226 \ \mbox{T-III} \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \$
<ul> <li>S774 15. 2013</li> <li>S774 15. 2013</li> <li>S776 16. 222</li> <li>S776 16. 223</li> <li>S776 16. 223</li> <li>S776 16. 223</li> <li>S777 16. 233</li> <li>S777 16. 16. 233</li> <li>S777 16</li></ul>	199         1. 200, 11, 99, 75           11. 199, 75         11. 199, 75           11. 199, 75         11. 199, 75           11. 199, 74         11. 199, 75           11. 199, 74         11. 199, 74           11. 199, 74         11. 199, 75           11. 199, 75         11. 199, 75           11. 199, 131         11. 199, 131           11. 199, 131         11. 199, 131           11. 199, 131         11. 199, 131           11. 199, 131         11. 199, 131           11. 199, 131         11. 42, 139           11. 199, 131         11. 42, 139           11. 1. 199, 135         11. 44, 149           11. 1. 44, 149         11. 44, 149, 143           11. 1. 44, 149, 143         11. 44, 149, 143           11. 1. 44, 149, 143         11. 44, 149, 143           11. 1. 44, 149, 443         11. 143, 145           11. 144, 149, 443         11. 144, 149, 443           11. 144, 149, 443         11. 144, 149           11. 144, 149, 443         11. 144, 149           11. 144, 149, 443         11. 144, 149           11. 144, 149, 443         11. 144, 149           11. 144, 149, 443         11. 144, 149           11. 144, 149, 443         11. 144, 149      1	$\begin{array}{c} 1.369, 111.9\\ 1.269, 0.57\\ 1.2200, 0.7\\ 1.2200, 0.7\\ 1.200, 0.7\\ 1.2000, 0.8$	413 473 473 473 473 473 473 473 473 473 47	$ \begin{array}{c} 226 \ \mbox{T-TU-T} & -7.11 \ \mbox{CU} & -5.01 \ \mbox{SU} & -5.01 \ \mbox{CU} & -5.01 \ CU$
<ul> <li>S7781 15. 7882</li> <li>S7781 15. 7882</li> <li>S7785 16. 232</li> <li>S7765 16. 232</li> <li>S7766 16. 232</li> <li>S7778 16. 232</li> <li>S7778 16. 232</li> <li>S7777 16. 232</li> <li>S7778 16. 232</li> <li>S7787 16. 232</li> <li>S7797 16. 232</li> <li>S7797</li></ul>	139         1. 200. 11. 98, 75           1. 1. 98, 75         11. 1. 98, 75           11. 1. 28, 14, 75         11. 1. 98, 75           11. 1. 28, 14, 75         11. 1. 98, 75           11. 1. 28, 14, 75         11. 1. 98, 75           11. 1. 28, 14, 75         11. 1. 98, 12           11. 1. 28, 14, 75         11. 1. 98, 12           11. 1. 108, 13         11. 1. 28, 16           11. 1. 28, 16         11. 1. 28, 16           11. 1. 128, 16         11. 1. 28, 16           11. 1. 128, 16         11. 1. 128, 15           11. 1. 128, 16         11. 1. 128, 15           11. 1. 128, 16         11. 1. 128, 123           11. 1. 128, 128         11. 1. 128, 123           11. 1. 128, 128         11. 1. 128, 123           11. 1. 128, 128         11. 1. 128, 123           11. 1. 128, 128         11. 1. 128, 123           11. 1. 128, 128         11. 1. 128, 123           11. 1. 128, 123         11. 1. 128, 123           11. 1. 128, 128         11. 1. 128, 128           11. 1. 128, 128         11. 1. 128, 128           11. 1. 128, 128         11. 1. 128, 131           11. 1. 128, 131         11. 128, 131           11. 128, 128         11. 1. 128, 131           11. 128, 128	$\begin{array}{c} 1.369, 114.9\\ 1.260, 6.7\\ 1.260, 6.7\\ 1.260, 6.7\\ 1.260, 6.9\\ 1.260, 6.$	413         413           471         497           491         497           491         497           491         497           491         497           491         497           491         497           491         497           491         497           491         497           493         497           497         497           497         497           497         497           497         497           497         497           497         497           497         497           497         497           497         497           497         497           497         497           497         497           497         497           497         497           497         497	$ \begin{array}{c} 226 \ \mbox{T-III} C - 7.11 \ \mbox{CV} \ \ \mbox{SSIC-0-712} 2260 \ \ \mbox{SSIC-0-712} \ \ \ \ \mbox{SSIC-0-712} \ \ \ \mbox{SSIC-0-712} \ \ \ \mbox{SSIC-0-712} \ \ \mbox{SSIC-0-712} \ \ \ \mbox{SSIC-0-712} \ \ \ \mb$
<ul> <li>5574: 15. 787</li> <li>5577: 15. 787</li> <li>5577: 15. 787</li> <li>5578: 16. 232</li> <li>5576: 16. 232</li> <li>5576: 16. 232</li> <li>55777: 16. 232</li> <li>55782: 16. 232</li> <li>55782: 16. 232</li> <li>55789: 16. 232</li> <li>55799: 16. 232</li></ul>	199         1. 2.80, 11, 9           11. 1. 90, 75           11. 1. 90, 75           11. 1. 90, 75           11. 1. 90, 75           11. 1. 90, 73           11. 1. 90, 73           11. 1. 90, 73           11. 1. 90, 73           11. 1. 90, 73           11. 1. 90, 73           11. 1. 90, 73           11. 1. 90, 73           11. 1. 90, 73           11. 1. 234, 95           11. 1. 234, 95           11. 1. 90, 73           11. 1. 90, 73           11. 1. 90, 73           11. 1. 90, 73           11. 1. 41, 190           11. 1. 41, 190           11. 1. 41, 190           11. 1. 151, 135           11. 1. 151, 135           11. 1. 151, 135           11. 1. 151, 135           11. 1. 151, 135           11. 1. 151, 135           11. 1. 151, 135           11. 1. 151, 135           11. 1. 152, 135           11. 1. 152, 135           11. 1. 152, 135           11. 1. 152, 135           11. 1. 152, 135           11. 1. 152, 135           11. 1. 152, 135           11. 1. 152, 135           11. 1. 152, 13	$\begin{array}{c} 1.369, 111.9\\ 1.200, 0.19\\ 1.200, 0.7\\ 1.200, 0.7\\ 1.200, 0.7\\ 1.200, 0.8\\ 1.200, 0.9\\ 1.200, 0.8\\ 1.200, 0$	413         413           413         403           403         403	226 FF-1TU-1 6.7.11 CPU, 556-C+7252880, See-5280, 226 FF-1TU-1 7, 17 CPU, 557-C+67525280, See-2385, 270 2778 - 80 2718 CPU, 557-C+6853115, See-2385, 270 2778 - 80 2718 CPU, 557-C+6853115, See-2385, 270 2778 - 81 270 278 278 - 81 277 2 278 - 85 278 278 - 81 278
<ul> <li>S773 15, 201</li> <li>S773 15, 201</li> <li>S775 15, 202</li> <li>S776 16, 222</li> <li>S776 16, 223</li> <li>S776 16, 223</li> <li>S777 16, 233</li> <li>S777 16, 232</li> <li>S778 16, 232</li> <li>S779 16, 232</li> <li>S779</li></ul>	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{c} 1.369, 111.9\\ 1.200, 6.7\\ 1.200, 6.7\\ 1.200, 6.7\\ 1.200, 6.7\\ 1.200, 6.9\\ 1.200, 6.9\\ 1.200, 6.9\\ 1.200, 6.9\\ 1.200, 6.9\\ 1.200, 6.3\\ 1.200, 6.3\\ 1.200, 6.3\\ 1.200, 6.3\\ 1.200, 6.3\\ 1.200, 6.4\\ 1.200, 6.$	413         413           413         413           413         413           414         413           415         413           415         413           415         413           414         413           415         413           415         413           415         413           415         413           415         413           415         413           416         413           417         413           418         413           419         413           419         413           410         413           411         414           411         414           411         414           411         414           411         414           411         414	$ \begin{array}{c} 226 \ \mbox{Tr} 110 \ \mbox{Tr} 0.11 \ \mbox{Tr} $
<ul> <li>S7781 15. 7878</li> <li>S7787 15. 7878</li> <li>S7787 15. 7878</li> <li>S7787 16. 232</li> <li>S7787 16. 232</li> <li>S7787 16. 232</li> <li>S7777 16. 232</li> <li>S7778 16. 232</li> <li>S7778 16. 232</li> <li>S7787 16. 232</li> <li>S7797 16. 232</li> <li>S7797</li></ul>	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{c} 1.369, 111.9\\ 1.126, 36, 71\\ 1.226, 64, 71\\ 1.226, 65, 10\\ 1.226, 06, 10\\ 1.200, 0.5, 91\\ 1.200, 0.5, 91\\ 1.200, 0.5, 91\\ 1.200, 0.5, 11\\ 1.200, 0.6, 11\\ 1.200, 0.6, 11\\ 1.200, 0.6, 10\\ 1.200, 0.6, 10\\ 1.200, 0.6, 10\\ 1.200, 0.6, 10\\ 1.200, 0.5, 1$	413         413           413         413           414         413           415	28         FT-TUD - T. 2.7.1         CVU, SST-6-72.32808         See-2365           28         FT-TUD - T. 2.7.1         CVU, SST-6-823135, See-2365         See-2365           28         FT-TUD - T. 2.7.1         CVU, SST-6-8633135, See-2365         See-2365           70         277.0         See 70
<ul> <li>S774 15. 2013</li> <li>S774 15. 2013</li> <li>S776 16. 222</li> <li>S776 16. 322</li> <li>S776 16. 323</li> <li>S777 16. 323</li> <li>S77</li></ul>	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{c} 1.369, 111.9\\ 1.260, 6.17\\ 1.200, 6.7\\ 1.200, 6.7\\ 1.200, 6.9\\ 1.200, 6.9\\ 1.200, 6.9\\ 1.200, 6.9\\ 1.200, 6.9\\ 1.200, 6.9\\ 1.200, 6.0\\ 1.200, 6$	413 413 413 413 413 413 413 413 413 413	28         FT-TUD - 6.7.12         CVD         SSE-6477322889         See-23853           28         FT-TUD - 6.7.12         CVD         SSE-64873125         Ssee-23853           70         27.701         CVD         SSE-64873125         Ssee-23853           70         27.701         CVD         SSE-64873125         Ssee-23853           70         27.701         CVD         SSE-6487         LOIC SYN           71         55.3468         CVD         SSE-6487         LOIC SYN           71         55.3468         CVD         SSE-6488         LOIC SYN           71         55.3468         CVD         SSE-6488         LOIC SYN           72         57.712         CVD         SSE-6488         LOIC SYN           73         57.712         CVD         SSE-6488         LOIC SYN           74         57.712         CVD         SSE-6488         LOIC SYN           74         57.712         CVD         SSE-6488         LOIC SYN         SSE-6488           74         SSE-6488         CVD         SSE-6488         SSE-6488         LOIC SYN         SSE-6488         LOIC SYN         SSE-6488         LOIC SYN         SSE-6488         LOIC SYN         SSE-6488
<ul> <li>S773 15, 201</li> <li>S773 15, 201</li> <li>S775 15, 202</li> <li>S776 16, 222</li> <li>S776 16, 223</li> <li>S776 16, 223</li> <li>S777 16, 232</li> <li>S778 16, 232</li> <li>S779 16, 232</li> <li>S779</li></ul>	No.         1.200.11.0         1.1.90.73           1.1.90.73         1.1.90.73           1.1.90.73         1.1.90.73           1.1.1.90.73         1.1.90.73           1.1.1.90.73         1.1.90.73           1.1.1.90.73         1.1.90.73           1.1.238.76         1.1.90.73           1.1.238.76         1.1.238.76           1.1.238.76         1.1.238.76           1.1.238.76         1.1.238.76           1.1.1.238.76         1.1.42.139           1.1.1.238.76         1.1.42.139           1.1.1.238.76         1.1.42.139           1.1.1.238.76         1.1.43.136           1.1.1.1.139.135         1.1.43.139           1.1.1.43.72         1.200.6.110           1.1.1.43.72         1.200.6.110           1.1.1.43.72         1.200.6.110           1.1.43.72         1.200.6.110           1.1.43.72         1.200.6.110           1.1.43.72         1.200.6.110           1.200.71         1.200.6.100           1.200.71         1.200.6.100           1.200.71         1.200.6.2           1.200.71         1.200.6.2           1.200.71         1.200.6.2           1.200.71         1.200.6.2	$\begin{array}{c} 1.369, 111.9\\ 1.260, 6.7\\ 1.260, 6.7\\ 1.260, 6.7\\ 1.260, 6.7\\ 1.260, 6.9\\ 1.260, 6.9\\ 1.260, 6.9\\ 1.260, 6.9\\ 1.260, 6.3\\ 1.260, 6.3\\ 1.260, 6.3\\ 1.260, 6.3\\ 1.260, 6.3\\ 1.260, 6.4\\ 1.260, 6.$	413 413 413 413 413 413 413 413 413 413	$ \begin{array}{c} 226 \ \mbox{Tr} 110 \ \mbox{Tr} 12 \ $
<ul> <li>S7781 15. 7878</li> <li>S7787 15. 7878</li> <li>S7787 15. 787</li> <li>S7787 16. 232</li> <li>S7768 16. 232</li> <li>S7768 16. 232</li> <li>S7778 16. 232</li> <li>S7777 16. 232</li> <li>S7778 16. 232</li> <li>S7778 16. 232</li> <li>S7778 16. 232</li> <li>S7778 16. 232</li> <li>S7787 16. 232</li> <li>S7797 16. 232</li> <li>S7797</li></ul>	191         1. 200, 11, 99, 75           11, 190, 12         11, 190, 75           11, 190, 12         11, 190, 12           11, 190, 12         11, 190, 12           11, 190, 12         11, 190, 12           11, 190, 12         11, 190, 12           11, 190, 12         11, 190, 13           11, 190, 13         11, 190, 13           11, 190, 13         11, 190, 13           11, 1, 190, 13         11, 190, 13           11, 1, 190, 13         11, 140, 160           11, 1, 140, 160         11, 145, 150           11, 144, 140         11, 145, 155           11, 144, 140         11, 145, 155           11, 145, 155         11, 145, 155           11, 145, 155         11, 145, 155           11, 145, 156         11, 145, 155           11, 145, 156         11, 145, 155           11, 145, 156         11, 145, 156           11, 145, 156         11, 145, 156           11, 145, 156         11, 145, 156           11, 145, 156         11, 145, 156           11, 145, 140, 167         11, 145, 140           11, 145, 140, 167         11, 145, 140           11, 145, 140, 167         11, 145, 140           11, 145, 140, 167         11, 145, 14	$\begin{array}{c} 1.308, 111.9\\ 1.1208, 0.47\\ 1.1208, 0.47\\ 1.208, 0.47\\ 1.208, 0.59\\ 1.208, 0.59\\ 1.208, 0.59\\ 1.208, 0.6, 0.57\\ 1.208, 0.6, 0.11\\ 1.208, 0.6, 0.11\\ 1.208, 0.6, 0.11\\ 1.208, 0.6, 0.11\\ 1.208, 0.6, 0.11\\ 1.208, 0.6, 0.10\\ 1.208, 0.0, 0.10\\ 1.208, 0.0, 0.0\\ 1.208, 0.0\\ 1.208, 0.0\\ 1.208, 0.0\\ 1.208, 0.$	413         413           414         413           415	226 FF-110-F 6.711 CPU, 556-C+7252806, See-5285, 226 FF-110-F 6.711 CPU, 556-C+67525286, See-2385, 226 FF-110-F, 711 CPU, 556-C+6853135, See-2385, 227 FF, 715
<ul> <li>S774 15. 2013</li> <li>S774 15. 2013</li> <li>S776 16. 222</li> <li>S776 16. 223</li> <li>S776 16. 223</li> <li>S777 16. 233</li> <li>S777 16. 233</li> <li>S777 16. 323</li> <li>S77</li></ul>	199         1. 200, 11, 99, 75           11. 199, 75         11. 99, 75           11. 199, 73         11. 99, 75           11. 199, 74         11. 199, 74           11. 199, 74         11. 199, 74           11. 199, 74         11. 199, 74           11. 199, 74         11. 199, 75           11. 199, 73         11. 199, 73           11. 199, 73         11. 199, 73           11. 199, 73         11. 199, 73           11. 199, 73         11. 42, 139           11. 199, 73         11. 42, 139           11. 199, 73         11. 42, 139           11. 199, 130         11. 44, 149           11. 199, 130         11. 44, 149           12. 199, 0, 11         11. 44, 44           12. 199, 0, 0, 11         11. 44, 44           12. 199, 0, 0, 11         11. 44, 44           12. 199, 0, 0, 11         11. 44, 44           12. 199, 0, 0, 11         11. 44, 44           12. 199, 0, 0, 11         11. 44, 44           12. 199, 0, 0, 11         11. 44, 44           12. 199, 0, 0, 11         11. 44, 44           12. 199, 0, 0, 11         11. 44, 44           12. 199, 0, 0, 11         11. 44, 49           12. 199, 0, 0, 11         11. 44, 49	$\begin{array}{c} 1.369, 111.9\\ 1.200, 0.57\\ 1.200, 0.7\\ 1.200, 0.57\\ 1.200, 0.57\\ 1.200, 0.59\\ 1.200, 0.5\\ 1.200, 0.5\\ 1.200, 0.5\\ 1.200, 0.5\\ 1.200, 0.5\\ 1.200, 0.6\\ 1.200$	418 418 418 418 418 418 418 418 418 418	$ \begin{array}{c} 226 \ \mbox{T-III} \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \$

FIGURE 4. LOIC-TCP-SYN flood packets (screenshot from Wireshark).

loses real-time capability. In this paper, we propose a single directional packet filter and tried to advance the detection to the attack accumulation stage. Fig. 3 describes the flow chart of the filter.

The filter takes every sent-in 5-tuple as an input, and only allows the tuples whose direction is the same with the first tuple of a flow to pass. The filter maintains a list to record the identifier of every flow. We reform each 5-tuple into a 3-part array[Src:[S\_IP, S\_Port], Dst:[D\_IP, D\_Port], P:Protocol], and whenever a 5-tuple is sent in, the filter first check whether [Src, Dst, P] or [Dst, Src, P] is already in the list. If [Src, Dst, P] doesn't exist, append [Src, Dst, P] into the list; else if [Src, Dst, P] exists, let the tuple pass the filter; else drop it.

Figure 4 shows a beginning part of an accumulation stage of a LOIC TCP SYN Flood DDoS attack. The attackers' IP range is 1.1.0.0/16, while the victim servers' IP fall in 1.200.0.0/24. In the example, we can easily notice that the distribution of source information and destination information becomes unexpectedly the same, and we are unable to locate the attacking event until we remove the response packets. Entropy theory is effective in DDoS detection because when an attack occurs, the IP addresses and port numbers of the malicious traffic are provided by thousands of millions of different hosts that are fake, virtual or illegally controlled, while under legal usage. However, they would be confined to a relatively small range, and that will show a sharp contrast from the entropy perspective.

1) OPTIMIZED SLIDING TIME WINDOW

$$H(X) = E[-\log p(x_i)] = -\sum_{i=1}^{n} p(x_i) \log p(x_i)$$
(1)

The entropy value can directly represent the distribution of information, but according to Shannon's original entropy formula (1), if we take all accumulated data as the input, whenever we receive new input, we have to recalculate the entropy. The time complexity of the original algorithm is  $O(n^2)$ , which will cause unacceptable responding time in DDoS detection. To avoid this disadvantage, Feinstein et al. use the sliding window while computing [20] and reduce the time complexity extremely from  $O(n^2)$  to  $O(w^2) = O(1)$ , where w is a constant value and is less than n. Because the series of entropy value describes the trend of the value distribution, the input values that have arrived too long before should have few influences on the current input. Therefore, we can set a proper constant width of a sliding window, i.e.  $10^4$  packets, and apply the sliding window to the input values to calculate the entropy. Comparing with (1), the upper bound of i is limited to be less than or equal to the width w. The method makes it possible to apply entropy to DDoS detection, but the response time can be further reduced. Taking the result as a basis, we propose 2 methods to further reduce the time complexity.

# a: VARIATION UPDATING METHOD

The calculation of the entropy is accumulative. If we apply a sliding time window, we can only recalculate the information content of both the slide-out and slide-in elements, and keep most other unaffected elements the same, thus simplifying the calculation. Supposing that there is an input sequence  $s[0:5] = [x_1, x_2, x_1, x_1, x_3, x_4]$ , and the width of the sliding window is w = 5. Then it is easy to calculate the entropy of the first sliding window:

$$H(x[0:4]) = h(x_1) + h(x_2) + h(x_3) = -\frac{3}{5} \cdot \log \frac{3}{5} - \frac{1}{5} \cdot \log \frac{1}{5} - \frac{1}{5} \cdot \log \frac{1}{5}$$
(2)

When the window slides forward by a step, the entropy becomes:

$$H(x[1:5]) = h(x_1) + h(x_2) + h(x_3) + h(x_4) = -\frac{2}{5} \cdot \log \frac{2}{5} - \frac{1}{5} \cdot \log \frac{1}{5} - \frac{1}{5} \cdot \log \frac{1}{5} - \frac{1}{5} \cdot \log \frac{1}{5} - \frac{1}{5} \cdot \log \frac{1}{5}$$
(3)

Giving a subscript of [0:4] to the information contents in (2) and [1:5] to those in (3), we can get the relation between (2) and (3):

$$H(x[1:5]) = H(x[0:4]) - h_{[0:4]}(x[0]) + h_{[1:5]}(x[0]) - h_{[0:4]}(x[5]) + h_{[1:5]}(x[5])$$
(4)

Let 
$$\Delta h(x) = h_{[1:5]}(x) - h_{[0:4]}(x)$$
:  
 $H(x[1:5]) = H(x[0:4]) + \Delta h(x[0]) + \Delta h(x[5])$  (5)

Using this method, the only thing to do is just to count how many times do the slide-in-and-out elements appear within the sliding time window, and the worst time complexity is O(2 \* w). Then we calculate the variation of their information contents to update the entropy value, thus getting the generalized (5) with the following hypothesis.

Given an *n*-length sequence S and a preset sliding window width w (w < n), let H(x) be the entropy value of the  $x^{th}$  wlength subsequence of S (marked as  $S_x$ ), and  $h_x(e)$  be the information content of an element e in  $S_x$ . The recurrence formula of entropy writes:

$$H(x) = \begin{cases} \sum_{e \in S_1} h(e) = -\sum_{e \in S_1} p(e) \log p(e), & x = 1\\ H(x-1) + \Delta h_x(e_{Out}) + \Delta h_x(e_{In}), & x > 1\\ \Delta h_x(e) = h_x(e) - h_{x-1}(e), & 1 \le x \le n - w + 1 \end{cases}$$
(6)

#### b: VALUE COUNTER DICTIONARY AND COUNTER MATRIX

Another realization is to build a dictionary to record the count numbers of every distinct element at every sliding since the very beginning. Taking the previous example, we now record all the count numbers:  $3 x_1 s$ ,  $1 x_2$  and  $1 x_3$  and record the result as a dictionary  $d = \{x_1 : 3, x_2 : 1, x_3 : 1\}$  to make the result formatted. Now we slide the time window, recount the elements and append the new dictionary to the former one:

$$D = \begin{bmatrix} \{x_1 : 3, x_2 : 1, x_3 : 1\}, \\ \{x_1 : 2, x_2 : 1, x_3 : 1, x_4 : 1\} \end{bmatrix}$$
(7)

Because we preset the window width to be 5, it's simple to count the number of all elements. But the situation could be worse as the w goes larger. So we set another variable X to record the to-be-slide-out element. In the example, we set  $X = x_1$ , and after we slide we update the counting number of  $x_1$  from 3 down to 2, and then check whether the newly slide-in element  $x_4$  already exists.

$$D = \begin{bmatrix} d_1 = \{x_1 : 3, x_2 : 1, x_3 : 1\}, \\ d_2 = d_1 + \{x_1 : -1, x_4 : 1\} \end{bmatrix}$$
(8)

The dictionaries of the whole sliding window can be

transformed into a counting matrix of  $C = \begin{bmatrix} v_1 \\ v_2 \\ \cdots \\ v_w \end{bmatrix}$ , where  $v_i$ 

is the value vector of  $d_i$ . In the example above, the matrix is  $C = \begin{bmatrix} 3 & 1 & 1 & 0 \\ 2 & 1 & 1 & 1 \end{bmatrix}$ . The entropy calculation formula can now be written in a matrix format:

$$H[i] = -\frac{v_i}{w} \cdot \log \frac{v_i^T}{w}, \quad 1 \le i \le w$$
(9)

Or:

$$H[C] = -\frac{C}{w} \cdot \log \frac{C^T}{w}$$
(10)

#### 2) JOINT ENTROPY

When a DDoS attack occurs, we usually see a sharp climbingup of the entropy of source IP and Ports because of the huge amount of distributed attacking devices. But the situation may be opposite if the target devices are so weak that they can be easily taken down by a few attacking nodes, or the attack is launched by some old-but-still-effective DDoS tools such as ddosim [28]. On the other point of view, we will see a sharp decline of the entropy of destination IP until the number of attack packets reaches the width of the entropy sliding window, and this is a traditional and the most popular detection basis. But actually, the result will be interfered with by some indicators such as the target numbers, policies that motivate traffic to burst up, which is called "a benign flash crowd" in Zhao's research [19], etc.

To solve these problems, we combine both source and destination segments and apply joint entropy to the timestamp attached 5-tuples. We use the joint couple of (s\_IP, s\_Port) instead of the source IP and source port, and then make it joint with destination segments as our final detection basis. We mark (s\_IP, s\_Port) as s and (d\_IP, d\_Port) as d, and the final detection basis can be written as (s, d), so that the fake going-down of source IP can be eliminated.

# C. DETECTION AND ALARM MODULE

#### 1) BACKGROUND TRAFFIC FILTER

We can now easily find the beginning of attacks even by our eyes, but in practice, the terrible jitters can confuse the computers. It is necessary to eliminate the influences of background noise. Because the entropy values are continuous time series, we can use a Long Short-Term Memory (LSTM) model to predict the following entropy values. The LSTM [29], [30] is an artificial Recurrent Neural Network (RNN) architecture. Unlike standard Feedforward Neural Networks, LSTM has feedback connections and can take past inputs into the calculation, which makes it capable to deal with sequence prediction missions. Bloomberg Business Week wrote: "These powers make LSTM arguably the most commercial AI achievement, used for everything from predicting diseases to composing music" [31]. We preset *lb* as the number of the previous values that LSTM model looks back, send the first *lb* values as the input sequence, and get a predicted output value p. Then we repeat the process, pump p into the bottom of *lb* sequence and pop out the top value, send it to LSTM and get the second p value, and so on.



FIGURE 5. Interval division of QuinDC.

### 2) QUINTILE DEVIATION CHECK ALGORITHM

As we've got the pre-processed and real-time entropy values, the next thing to do is to make an immediate check and alarm for the suspicious packets. There are many deviation check algorithms: Quartile Deviation [32], [33], Generalized Extreme Studentized Deviate (GESD) [34], Linear Regression, Confidence Interval, etc. In this paper, we concern more about the sensitivity, and the values are nearly continuous, so we decide to redesign the Quartile Deviation algorithm. Quartile Deviation departs ascending sequence values into 4 equal-length subintervals and marks the 3 quartile points as Q1(25%), Q2(50%) and Q3(75%). The deviation value is Q3-Q1, which means 50% of the values are in [Q1, Q3], and the maximum deviation is Q3-Q1.

We made a great modification to the original Quartile Deviation algorithm, and name it as Quintile Deviation Check (abbr. QuinDC). Since we have to consider both directions of the curve trend, we extended the number of subintervals to 5 unequal-length subintervals and named them as Divergent Interval (Upward), Shock Interval (Upward), Convergent Interval, Shock Interval (Downward) and Divergent Interval (Downward) as shown below. The core parameters of QuinDC is the previous average value e and the previous radius value r (half of the value of which in traditional Quartile Deviation algorithm). We set e as the central basis of every test data, and determine the division points with  $e, e \pm r$  and  $e \pm 2r$ . If a value falls in the interval of [e - e]r, e + r], we mark it as 'convergent'; if it falls in the interval of [e - 2r, e - r] or [e + r, e + 2r], we mark it as 'shock'; and if it is larger than e + 2r or less than e - 2r, then we mark it as 'divergent'. Those divergent values are what we concern about, and we can then turn to research what kind of data shows abnormal behavior. We introduce 3 new parameters, N, k and  $\phi$  to solve this problem.

As is shown in Fig. 5, we apply an *N*-length sliding window here and divide the N-length sequence into *k*-length groups in the pattern shown in Fig. 6. Generally, *N* cannot be divided by *k*, so we just get rid of the beginning N%kvalues. Because the sequence or array is checked with a



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FIGURE 6. The group division diagram of QuinDC.

sliding window, this operation won't cause a bad affect on the result.

Finally, we set  $\phi$  as the threshold of the alarm trigger, and summarize the following two alarm principles:

1) Monotonicity: The average value of all groups must be monotonic.

2) Divergency:  $\phi$  of the values in the sliding window should be in the divergent intervals determined by the first  $\phi$  of the sliding window in the previous step. The system will send out an alarm as soon as the 2 principles are both met.

# **V. SIMULATION AND EVALUATION**

#### A. DATASETS SELECTION

In this paper, we use 3 public datasets and a generated dataset for testing. The public datasets are the 1999 DARPA Intrusion Detection Evaluation Data Set [35]–[37], 2009 DARPA DDOS Dataset [38], and the UNB CIC DDoS 2019 Evaluation Dataset [39]. The generated dataset is an emulation SDN-environment DDoS attack traffic generated by IXIA traffic simulator [40]. The 1999 & 2009 DARPA datasets are classical in DDoS evaluation. The CIC DDoS 2019 dataset is the newest dataset that including more modern attacking methods than the previous two datasets. The IXIA dataset is used as a supplement for testing the real-time performance in the SDN environment.

The DARPA datasets mainly provide TCP SYN Flood attack traffic, while in the CIC dataset, there are much more types of DDoS traffic: Network Time Protocol (NTP), Domain Name System (DNS), Lightweight Directory Access Protocol (LDAP), MSSQL, NetBIOS, Simple Network Management Protocol (SNMP), Simple Service Discovery Protocol (SSDP), User Datagram Protocol (UDP), UDP-Lag, WebDDoS, SYN, Trivial File Transfer Protocol (TFTP), etc. The IXIA BreakingPoint network tester simulates different DDoS attack scenarios and sends out the traffic packets. In the dataset, the types of DDoS attacks consist of generated simple attacks (such as SYN Flood, UDP Flood, and HTTP Flood) and simulated toolkit attacks (such as TCP and UDP attacks with different frequencies, background traffics or traffic-peak values).

# **B. SIMULATION OF RTVD DETECTION**

Traditionally, we will see the entropy curves of source IP and destination IP in a volumetric DDoS like the black and





FIGURE 7. Joint entropy curves.

red curves shown in Fig. 7a, which describe the entropy changes from the occurrence of the attack to its saturation status. But if there are some indicators of specific attacking methods or legal flash crowd etc., like the black and red curves shown in Fig. 7b, it can be difficult to tell when to use the source IP or the destination IP for detection. But after we apply the joint entropy, as the blue curves shown in Fig. 7a and Fig. 7b, the situations become unified. So far, the data preparation has been completed.

Now we realize the IoT background packet filter. Fig. 8 shows the real entropy data and its LSTM-predicted data. We can see irregular but legal (for these entropy comes from benign background traffic without any attack) serrations in the real blue entropy line and the highly-coincident predicted red line. We let the LSTM prediction model continuously predict the future entropy with a benign input. Then, we still use a sliding time window, pump the predicted value into the input sequence, then pop out the oldest value. Therefore, the prediction keeps going on.



FIGURE 8. Background entropy filter using LSTM.

Since we've got the prediction entropy values of the background traffic, we can make a subtraction to eliminate the background noise, thus cutting down the false alarm rate.

# C. EVALUATION

We've already been able to receive the traffic from an IoT network and calculate the real-time entropy values of that traffic. The only thing to do is to use QuinDC to find when the attacks occur. Before the final detection, we first made several tests to decide the optimal parameters  $N, k, \phi$  in QuinDC. We select the traditional Receiver Operating Characteristic (RoC) indices of False Positive Rate (FPR) and False Positive Rate (FPR) to evaluate the QuinDC performance under different parameters.

$$\begin{cases} TPR = \frac{TP}{TP + FN} \\ FPR = \frac{FP}{FP + TN} \end{cases}$$
(11)

Generally, the TPR will raise together with the FPR from both 0% to near both 100%, and we hope to find the point where the TPR is as high as possible, and the FPR is as low as possible in the meanwhile. That is to say, what we want is the certain combination of  $(N, k, \phi)$  that makes the point of (TPR, FPR) closest to the top-left point in the coordinates. In Fig. 9, there are three RoC curves represent IXIA SYN Flood, CIC 2019 DDoS Dataset and DARPA 1999 DDoS Dataset. Since We succeeded in detecting all the DDoS attacks listed in the dataset providers' attackingtimeline files, so we turn to evaluate the TPR and FPR with how many 'attacking packets' will QuinDC identify or omit. According to the result shown in Fig. 9, the best parameter combination is: N = 500, k = 100,  $\phi = 0.4$ , which means the width of a QuinDC sliding window is 500 packets, the group size is 100 packets, and at least 40% of the values in a sliding window should fall in the  $I_{DU}$  which is determined by the first 40% values in the previous sliding window.

#### TABLE 2. TFOR of different DDoS attacks using QuinDC.

Simulation	Timestamp of Attack	Timestamp of Attack	Alarm Delay		
Simulation	Started	Detected	(second)		
SYN Flood with no Background Traffic	1558359825.41888	1558359825.42462	0.00574	0.019133%	
SYN Flood with Single Background Traffic	1558448841.30895	1558448841.31410	0.00515	0.017167%	
SYN Flood with Mixed Background Traffic	1558364138.11221	1558364138.11660	0.00439	0.014633%	
DNS Amplification	1558519298.38008	1558519298.38314	0.00306	0.010200%	
LOIC HTTP Flood with Background Traffic	1558445608.31978	1558445608.32563	0.00585	0.019499%	
LOIC HTTP Flood	1558445361.56058	1558445361.58692	0.02634	0.087800%	
LOIC TCP UDP Mixed Attack	1558518501.53957	1558518501.61041	0.07084	0.236133%	
LOIC TCP Flood	1558360113.90172	1558360113.90173	0.00001	0.000033%	
DARPA 1999 Neptune TCP SYN Flood	921168256.32867	921168256.32867	0.00000	0.000000%	
DARPA 1999 Neptune TCP SYN Flood	921255612.09387	921255612.13946	0.04559	0.101313%	
DARPA 2009 DDoS TCP SYN Flood	1257425451.46404	1257425451.58030	0.11626	0.258356%	
CIC 2019 DNS Amplification	1541249612.64374	1541249613.36564	0.72190	1.604222%	
CIC 2019 LDAP Amplification	1541251314.31492	1541251314.34196	0.02704	0.060089%	
CIC 2019 NetBios Amplification	1541253013.39668	1541253013.42064	0.02396	0.053244%	
CIC 2019 SSDP Amplification	1541255357.76567	1541255357.78082	0.01515	0.033666%	
CIC 2019 Web DDoS	1541258171.78800	1541258171.85230	0.06430	0.142888%	
CIC 2019 SYN Flood	1541258870.05899	1541258871.06661	1.00762	2.239156%	
CIC 2019 TFTP	1541259206.51490	1541259207.10361	0.58871	1.308245%	
	0.015172	0 344765%			



**FIGURE 9.** The RoC curves of datasets under different  $N, k, \phi$ .

The TPR of modern DDoS detection is 100%, and the TPR of attacking packets detection is over 90%, with a low FPR of less than 3%. Furthermore, we redesigned another indicator of Temporal False Omission Rate (TFOR) (10) to evaluate the time performance of response. Traditionally, researchers will use a False Omission Rate (FOR) to evaluate the rate of omitted positive samples.

$$FOR = \frac{FN}{FN + TN} \tag{12}$$

However, in this paper, we do not care about the other positive samples but want to know how fast can we find the first true attack packet. So we modified (12) and added the temporal variables, and get the TFOR formula as (10).

$$TFOR = \frac{A larm \ Delay}{A larm \ Delay + E lapsed \ Benign \ Duration}$$
(13)

With this revision, we can evaluate a detection scheme to be sensitive and fast with a lower TFOR value. If the system



FIGURE 10. TFOR of different DDoS attacks using QuinDC.

recognizes an attack at its first attacking packet, then the value of *Alarm Delay* is 0, and the TFOR will be 0%. Otherwise, with the sliding window running, if the system fails to recognize any of the attacking packets, then the TFOR value will raise up and finally reach 100% because there are no packets before the attack and the value of *Elapsed Benign Duration* is 0. We simulate different types of DDoS attacks from the 4 datasets, and the TFOR results are shown in Fig.10 and listed in detail in Table 2. Most TFOR are less than 0.5% and have an average TFOR of 0.344765%. Also, the scheme can recognize all the volumetric DDoS attacks in an average delay of 0.015172 second.

#### **VI. CONCLUSION**

In this paper, we optimized the joint entropy calculation process and designed the algorithm of Quintile Deviation Check (QuinDC) to realize RTVD: a real-time volumetric detection scheme for DDoS in the Internet of Things. The techniques of sliding window, timestamp attached 5-tuple, and single directional packet filter make it possible to do entropy calculation in real-time. Furthermore, the QuinDC provides a lowlatency and accurate performance, so that it can be applied in systems with the real-time requirement, such as intrusion defense systems in IoT environments. In future research, we will try to use LSTM or GRU for directly IoT DDoS detection, and focus on the Slow DDoS, as well as real-time volumetric DDoS taxonomy.

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