Large-scale Network Monitoring for Visual Analysis of Attacks

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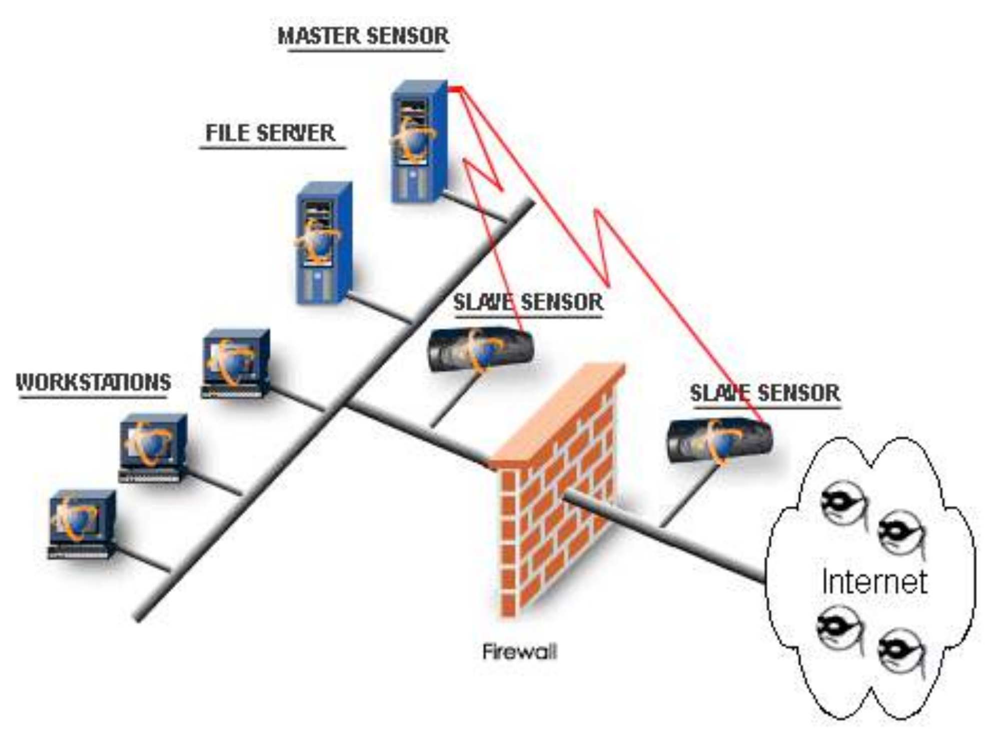
Presenter: Robin Berthier, University of Maryland, College Park

VizSec 2008 - Workshop on Visualization for Computer Security

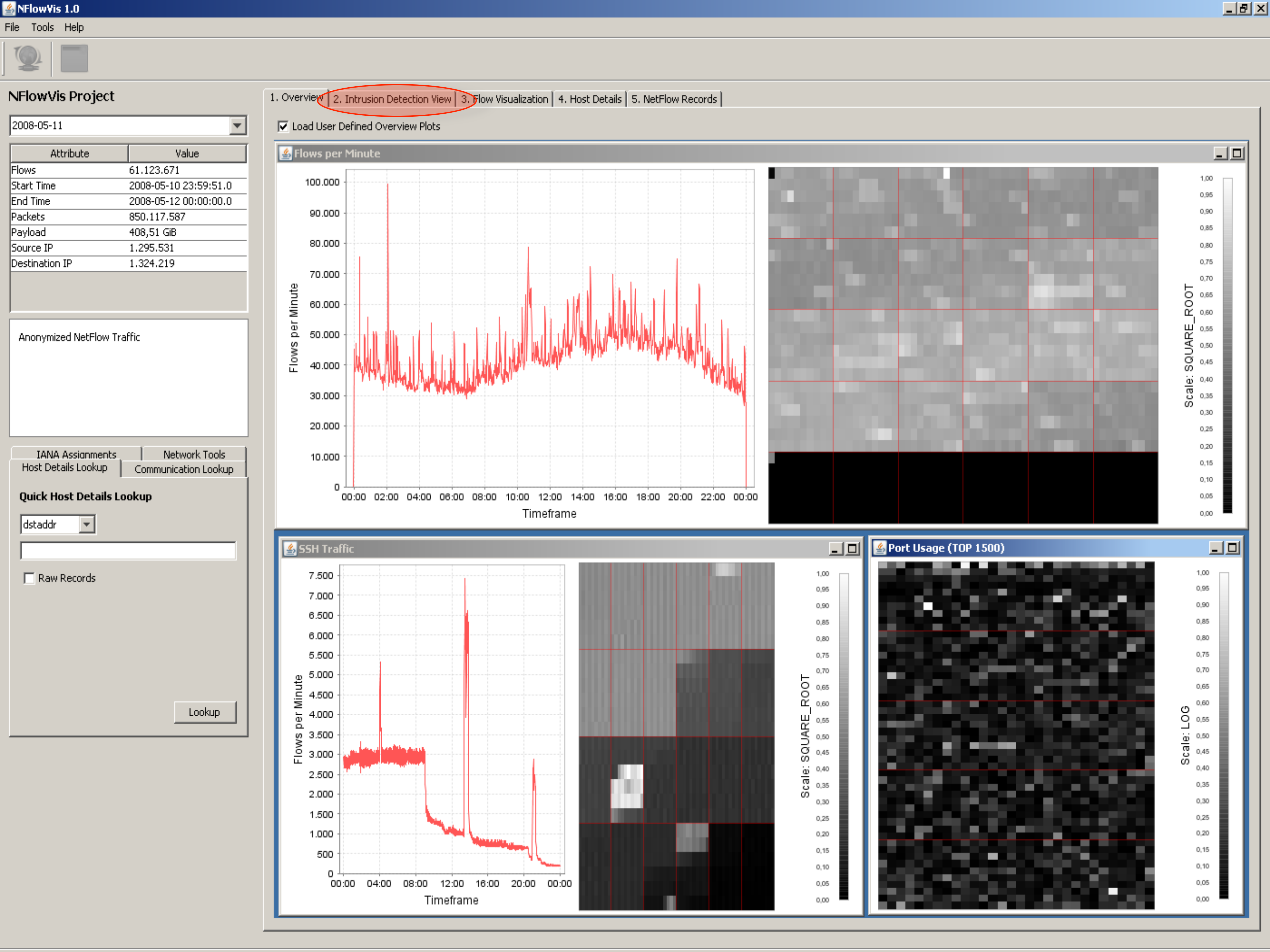
Intrusion Detection and Network Monitoring

- Network protection by
  - Firewalls
  - Intrusion Detection
  - Network Monitoring
- Problem:

  Intrusion Detection and Network Monitoring lead to *very large* number of alerts



How can we support the users of Intrusion Detection System and Network Monitoring Systems to understand the threat situation?



NFlowVis Project

2008-05-11

Attribute	Value
Flows	61.123.671
Start Time	2008-05-10 23:59:51.0
End Time	2008-05-12 00:00:00.0
Packets	850.117.587
Payload	408,51 GiB
Source IP	1.295.531
Destination IP	1.324.219

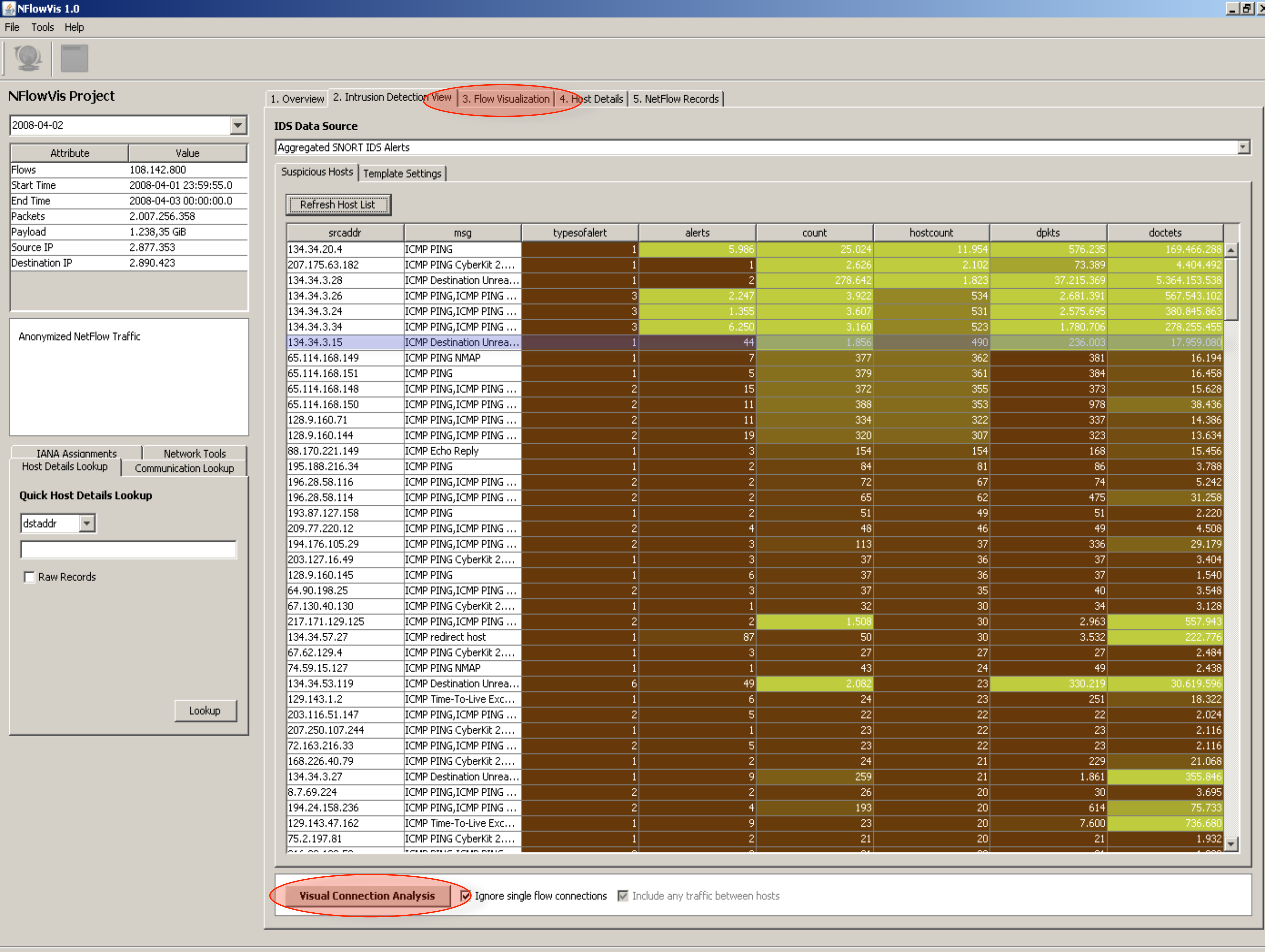
Anonymized NetFlow Traffic

Quick Host Details Lookup

dstaddr

□ Raw Records

☑ Load User Defined Overview Plots



2008-04-02

Attribute	Value
Flows	108.142.800
Start Time	2008-04-01 23:59:55.0
End Time	2008-04-03 00:00:00.0
Packets	2.007.256.358
Payload	1.238,35 GiB
Source IP	2.877.353
Destination IP	2.890.423

Anonymized NetFlow Traffic

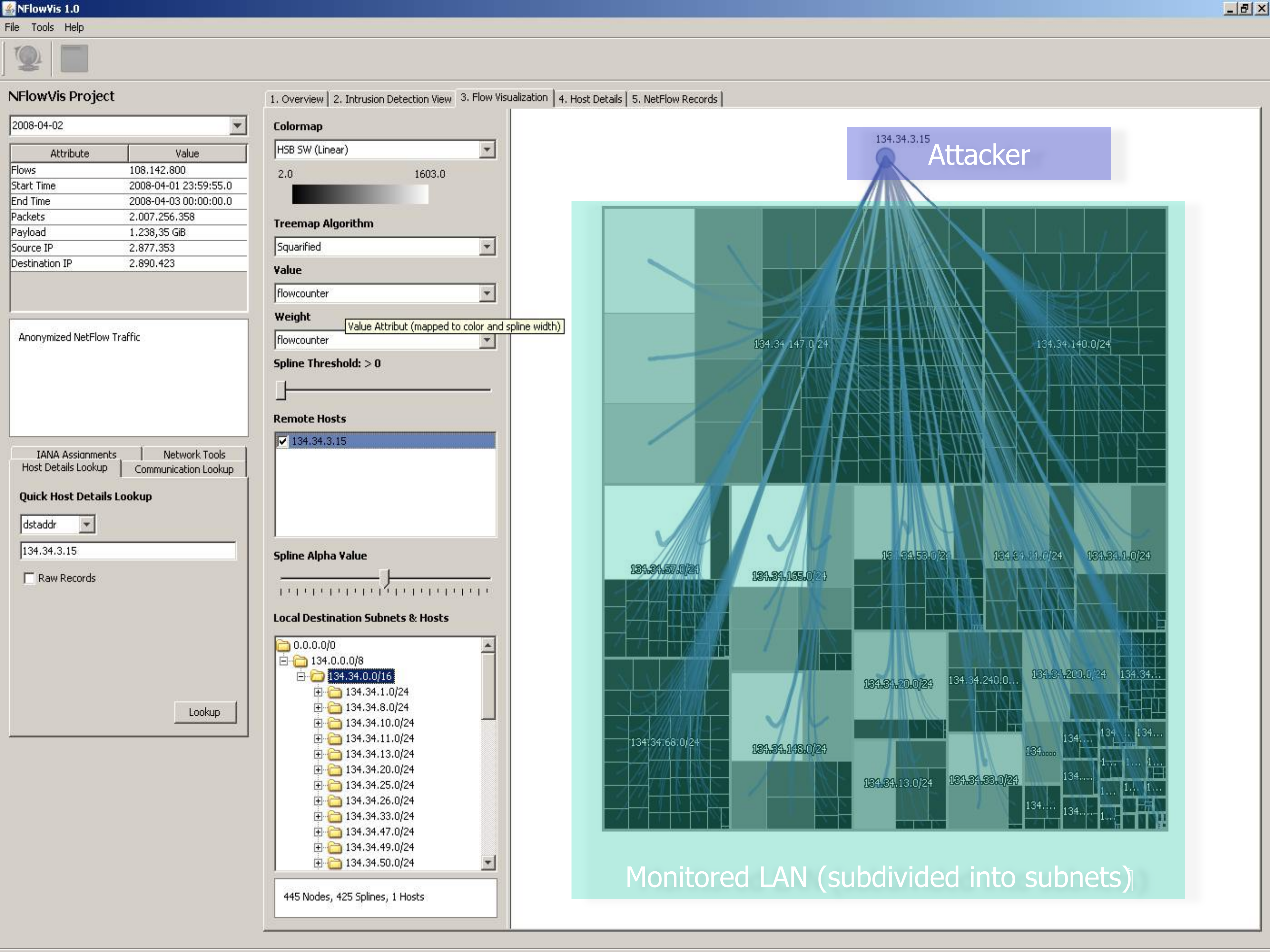
dstaddr

□ Raw Records

Aggregated SNORT IDS Alerts

srcaddr	msg	typesofalert	alerts	count	hostcount	dpkts	doctets
134.34.20.4	ICMP PING	1	5.986	25.024	11.954	576.235	169.466.288
207.175.63.182	ICMP PING CyberKit 2....	1	1	2.626	2.102	73.389	4.404.492
134.34.3.28	ICMP Destination Unrea...	1	2	278.642	1.823	37.215.369	5.364.153.538
134.34.3.26	ICMP PING,ICMP PING ...	3	2.247	3.922	534	2.681.391	567.543.102
134.34.3.24	ICMP PING,ICMP PING ...	3	1.355	3.607	531	2.575.695	380.845.863
134.34.3.34	ICMP PING,ICMP PING ...	3	6.250	3.160	523	1.780.706	278.255.455
134.34.3.15	ICMP Destination Unrea...	1	44	1.856	490	236.003	17.959.080
65.114.168.149	ICMP PING NMAP	1	7	377	362	381	16.194
65.114.168.151	ICMP PING	1	5	379	361	384	16.458
65.114.168.148	ICMP PING,ICMP PING ...	2	15	372	355	373	15.628
65.114.168.150	ICMP PING,ICMP PING ...	2	11	388	353	978	38.436
128.9.160.71	ICMP PING,ICMP PING ...	2	11	334	322	337	14.386
128.9.160.144	ICMP PING,ICMP PING ...	2	19	320	307	323	13.634
88.170.221.149	ICMP Echo Reply	1	3	154	154	168	15.456
195.188.216.34	ICMP PING	1	2	84	81	86	3.788
196.28.58.116	ICMP PING,ICMP PING ...	2	2	72	67	74	5.242
196.28.58.114	ICMP PING,ICMP PING ...	2	2	65	62	475	31.258
193.87.127.158	ICMP PING	1	2	51	49	51	2.220
209.77.220.12	ICMP PING,ICMP PING ...	2	4	48	46	49	4.508
194.176.105.29	ICMP PING,ICMP PING ...	2	3	113	37	336	29.179
203.127.16.49	ICMP PING CyberKit 2....	1	3	37	36	37	3.404
128.9.160.145	ICMP PING	1	6	37	36	37	1.540
64.90.198.25	ICMP PING,ICMP PING ...	2	3	37	35	40	3.548
67.130.40.130	ICMP PING CyberKit 2....	1	1	32	30	34	3.128
217.171.129.125	ICMP PING,ICMP PING ...	2	2	1.508	30	2.963	557.943
134.34.57.27	ICMP redirect host	1	87	50	30	3.532	222.776
67.62.129.4	ICMP PING CyberKit 2....	1	3	27	27	27	2.484
74.59.15.127	ICMP PING NMAP	1	1	43	24	49	2.438
134.34.53.119	ICMP Destination Unrea...	6	49	2.082	23	330.219	30.619.596
129.143.1.2	ICMP Time-To-Live Exc...	1	6	24	23	251	18.322
203.116.51.147	ICMP PING,ICMP PING ...	2	5	22	22	22	2.024
207.250.107.244	ICMP PING CyberKit 2....	1	1	23	22	23	2.116
72.163.216.33	ICMP PING,ICMP PING ...	2	5	23	22	23	2.116
168.226.40.79	ICMP PING CyberKit 2....	1	2	24	21	229	21.068
134.34.3.27	ICMP Destination Unrea...	1	9	259	21	1.861	355.846
8.7.69.224	ICMP PING,ICMP PING ...	2	2	26	20	30	3.695
194.24.158.236	ICMP PING,ICMP PING ...	2	4	193	20	614	75.733
129.143.47.162	ICMP Time-To-Live Exc...	1	9	23	20	7.600	736.680
75.2.197.81	ICMP PING CyberKit 2....	1	2	21	20	21	1.932

☑ Ignore single flow connections ☑ Include any traffic between hosts



NFlowVis Project

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Packets	2.007.256.358
Payload	1.238,35 GiB
Source IP	2.877.353
Destination IP	2.890.423

Anonymized NetFlow Traffic

Quick Host Details Lookup

dstaddr

134.34.3.15

□ Raw Records

Colormap

HSB SW (Linear)

2.0 1603.0

Treemap Algorithm

Squarified

Value

flowcounter

Weight

Value Attribut (mapped to color and spline width)

flowcounter

Spline Threshold: > 0

Remote Hosts

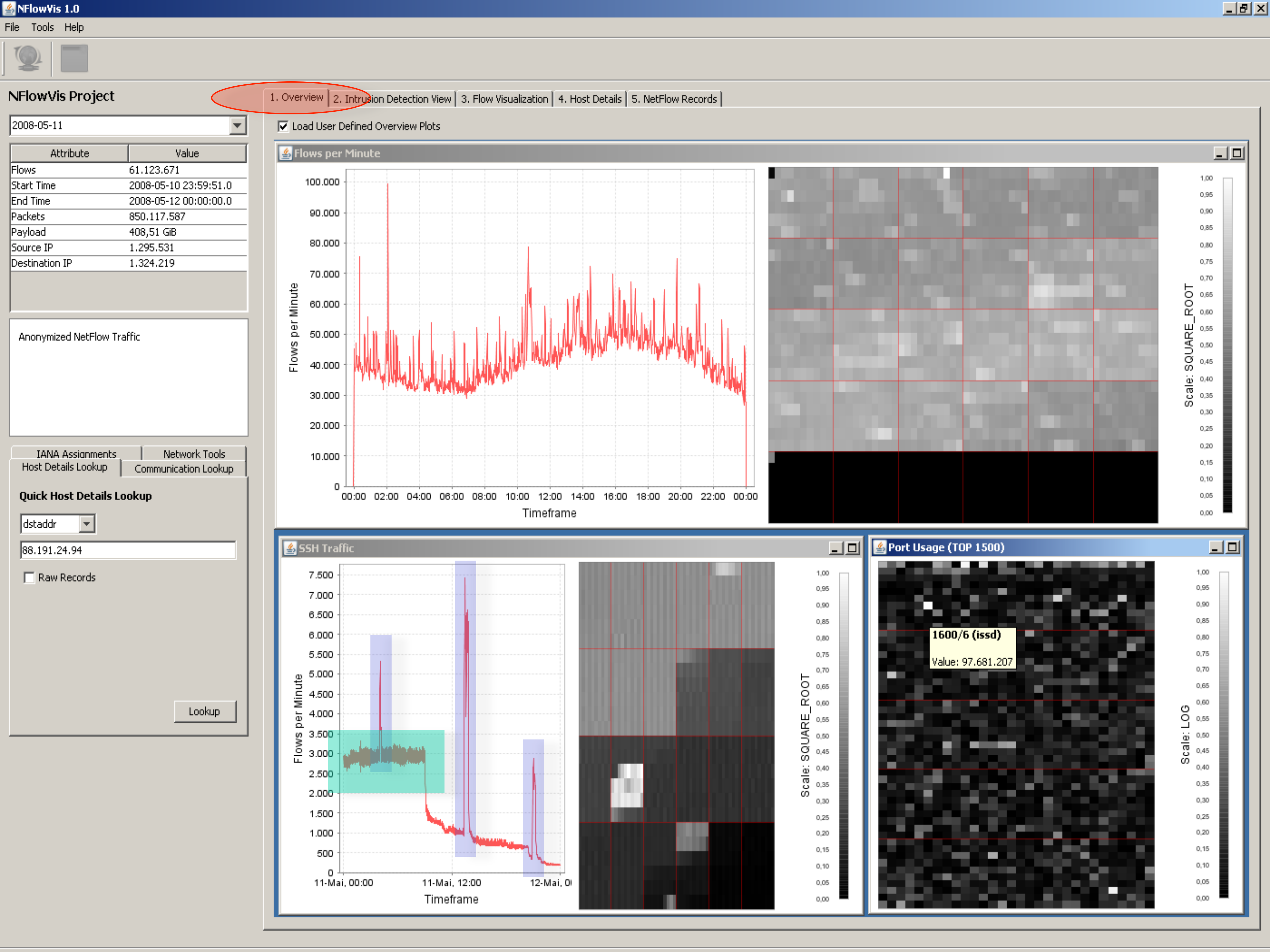
☑ 134.34.3.15

Spline Alpha Value

Local Destination Subnets & Hosts

```
0.0.0.0/0
⊟ 134.0.0.0/8
   ⊟ 134.34.0.0/16
      ⊞ 134.34.1.0/24
      ⊞ 134.34.8.0/24
      ⊞ 134.34.10.0/24
      ⊞ 134.34.11.0/24
      ⊞ 134.34.13.0/24
      ⊞ 134.34.20.0/24
      ⊞ 134.34.25.0/24
      ⊞ 134.34.26.0/24
      ⊞ 134.34.33.0/24
      ⊞ 134.34.47.0/24
      ⊞ 134.34.49.0/24
      ⊞ 134.34.50.0/24
```

445 Nodes, 425 Splines, 1 Hosts



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Payload	408,51 GiB
Source IP	1.295.531
Destination IP	1.324.219

Anonymized NetFlow Traffic

Quick Host Details Lookup

dstaddr

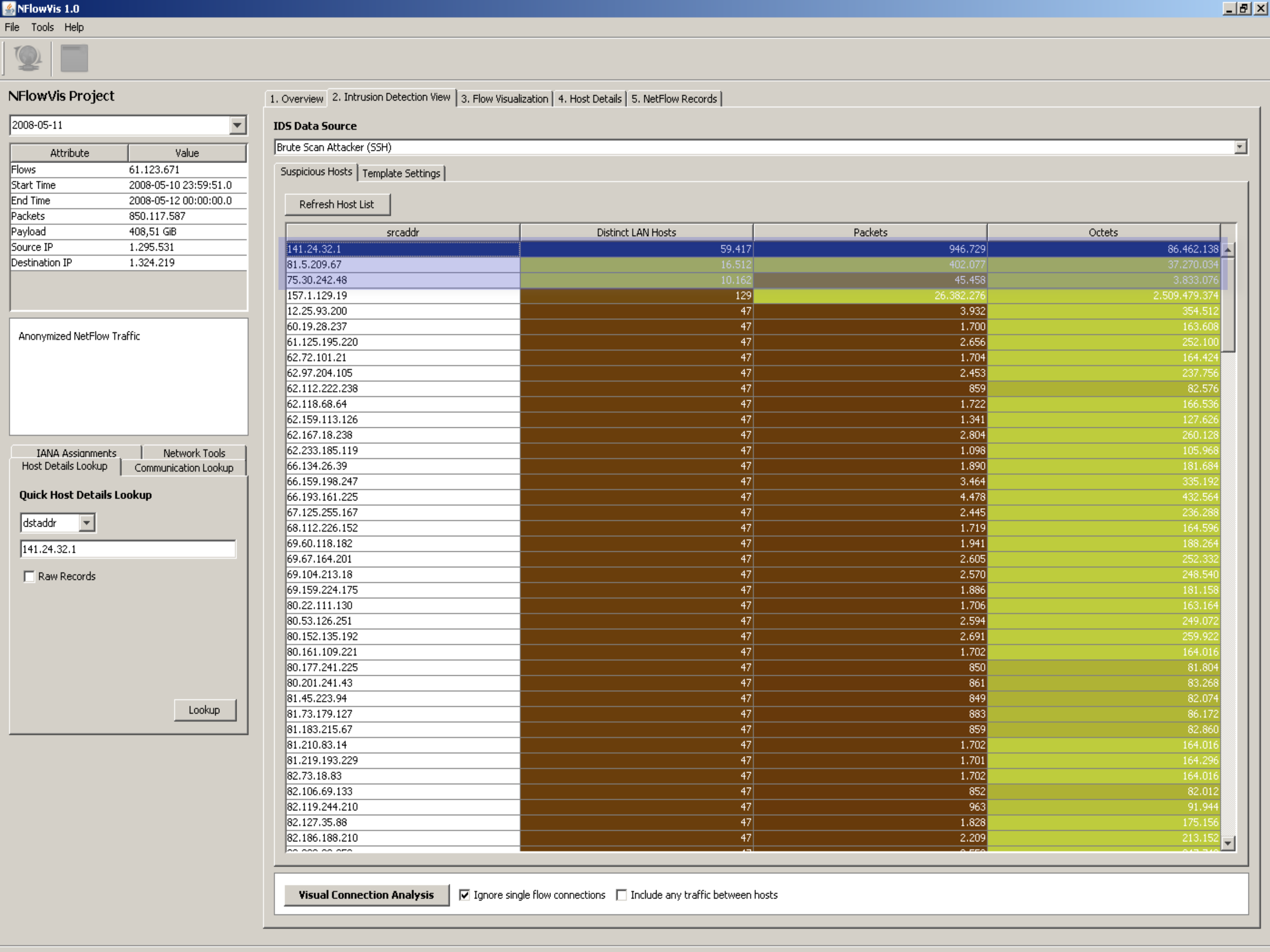
88.191.24.94

☐ Raw Records

☑ Load User Defined Overview Plots

1600/6 (issd)

Value: 97.681.207



NFlowVis Project

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Start Time	2008-05-10 23:59:51.0
End Time	2008-05-12 00:00:00.0
Packets	850.117.587
Payload	408,51 GiB
Source IP	1.295.531
Destination IP	1.324.219

Anonymized NetFlow Traffic

Quick Host Details Lookup

dstaddr

141.24.32.1

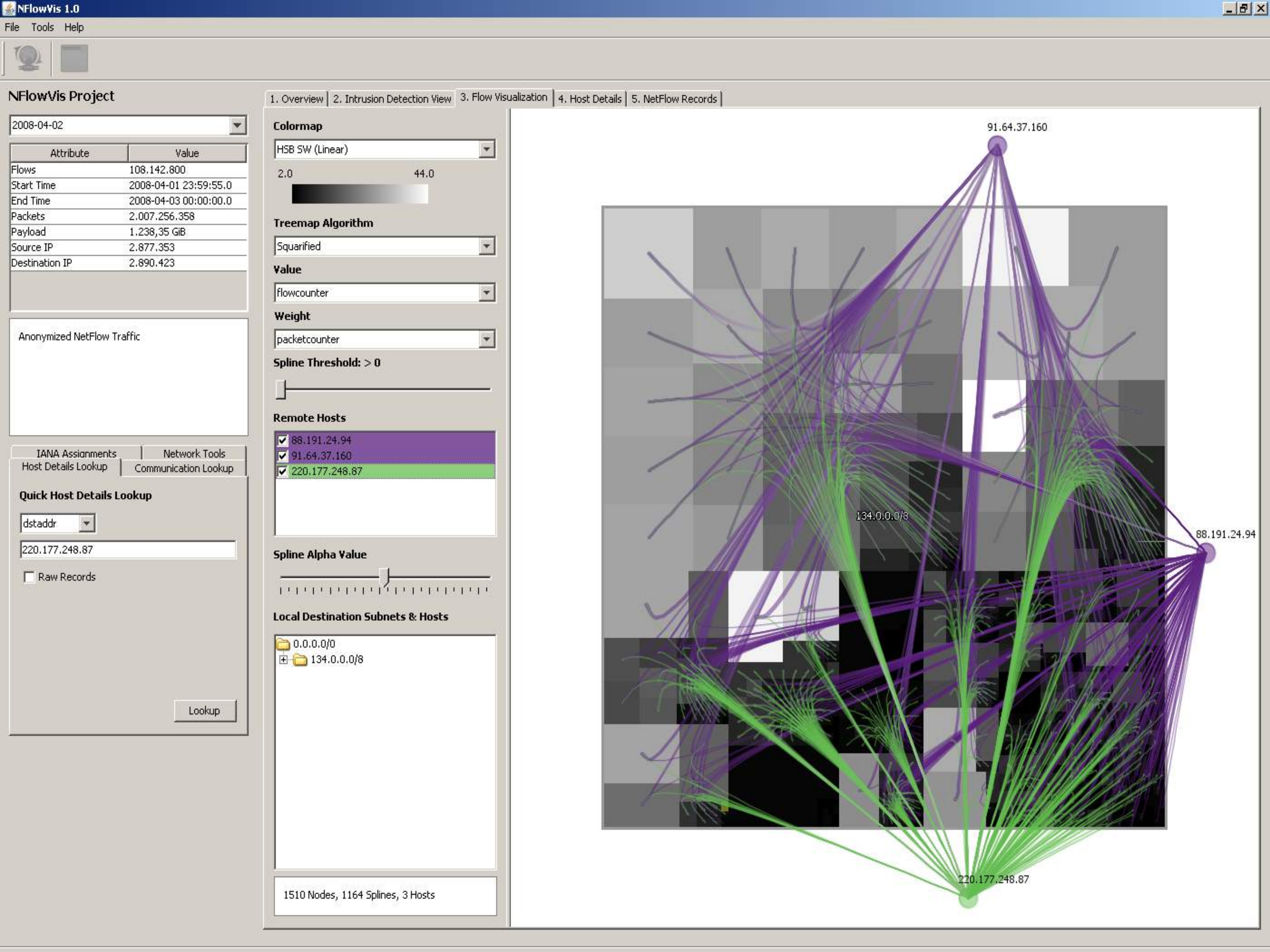
☐ Raw Records

IDS Data Source

Brute Scan Attacker (SSH)

srcaddr	Distinct LAN Hosts	Packets	Octets
141.24.32.1	59.417	946.729	86.462.138
81.5.209.67	16.512	402.077	37.270.034
75.30.242.48	10.162	45.458	3.833.076
157.1.129.19	129	26.382.276	2.509.479.374
12.25.93.200	47	3.932	354.512
60.19.28.237	47	1.700	163.608
61.125.195.220	47	2.656	252.100
62.72.101.21	47	1.704	164.424
62.97.204.105	47	2.453	237.756
62.112.222.238	47	859	82.576
62.118.68.64	47	1.722	166.536
62.159.113.126	47	1.341	127.626
62.167.18.238	47	2.804	260.128
62.233.185.119	47	1.098	105.968
66.134.26.39	47	1.890	181.684
66.159.198.247	47	3.464	335.192
66.193.161.225	47	4.478	432.564
67.125.255.167	47	2.445	236.288
68.112.226.152	47	1.719	164.596
69.60.118.182	47	1.941	188.264
69.67.164.201	47	2.605	252.332
69.104.213.18	47	2.570	248.540
69.159.224.175	47	1.886	181.158
80.22.111.130	47	1.706	163.164
80.53.126.251	47	2.594	249.072
80.152.135.192	47	2.691	259.922
80.161.109.221	47	1.702	164.016
80.177.241.225	47	850	81.804
80.201.241.43	47	861	83.268
81.45.223.94	47	849	82.074
81.73.179.127	47	883	86.172
81.183.215.67	47	859	82.860
81.210.83.14	47	1.702	164.016
81.219.193.229	47	1.701	164.296
82.73.18.83	47	1.702	164.016
82.106.69.133	47	852	82.012
82.119.244.210	47	963	91.944
82.127.35.88	47	1.828	175.156
82.186.188.210	47	2.209	213.152

☑ Ignore single flow connections ☐ Include any traffic between hosts



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Payload	1.238,35 GiB
Source IP	2.877.353
Destination IP	2.890.423

Anonymized NetFlow Traffic

Quick Host Details Lookup

dstaddr

220.177.248.87

☐ Raw Records

Colormap

HSB SW (Linear)

2.0 44.0

Treemap Algorithm

Squarified

Value

flowcounter

Weight

packetcounter

Spline Threshold: > 0

Remote Hosts

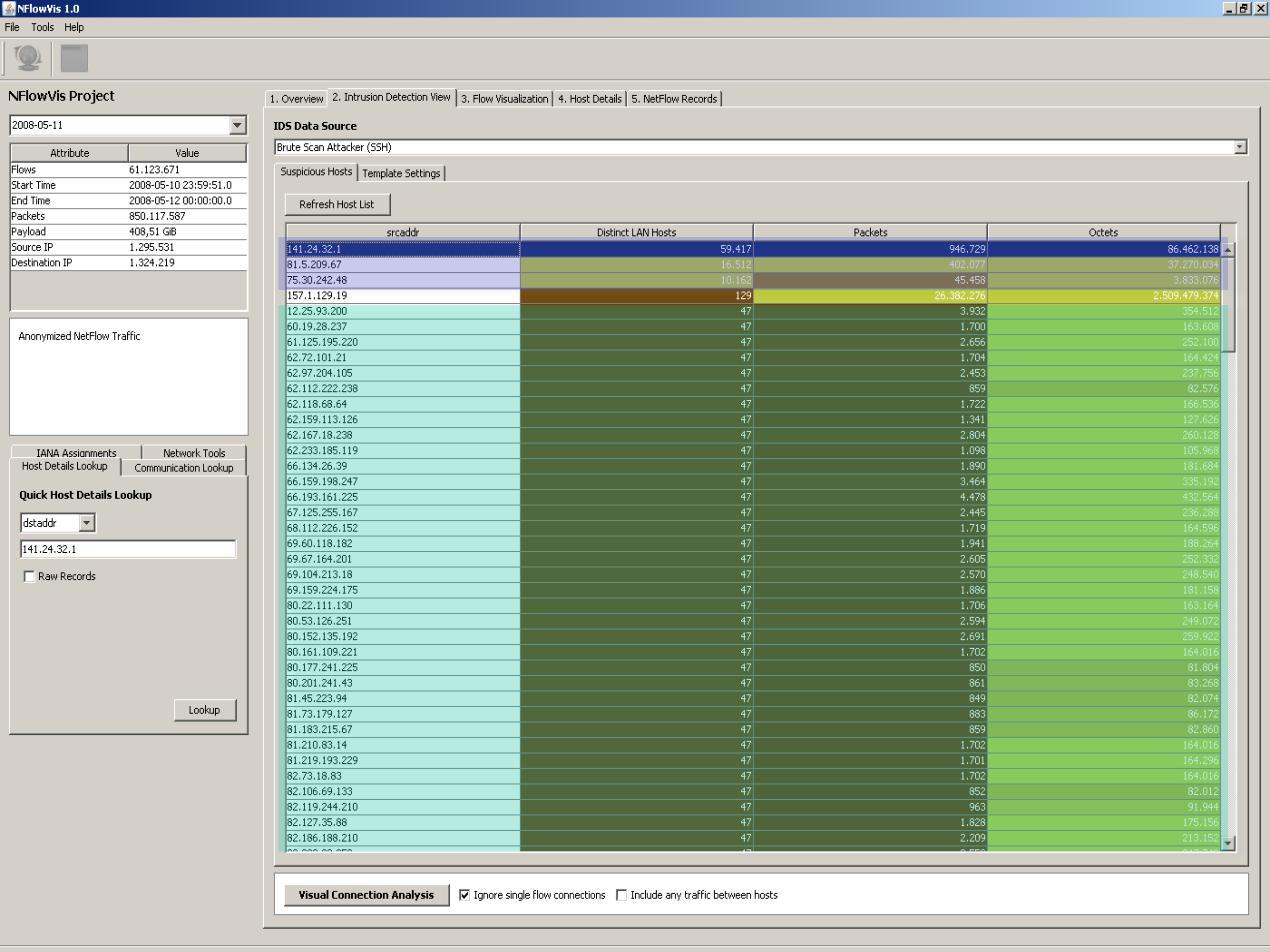
☑ 88.191.24.94
☑ 91.64.37.160
☑ 220.177.248.87

Spline Alpha Value

Local Destination Subnets & Hosts

0.0.0.0/0
⊞ 134.0.0.0/8

1510 Nodes, 1164 Splines, 3 Hosts



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Anonymized NetFlow Traffic

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dstaddr

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☐ Raw Records

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75.30.242.48	10.162	45.458	3.833.076
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12.25.93.200	47	3.932	354.512
60.19.28.237	47	1.700	163.608
61.125.195.220	47	2.656	252.100
62.72.101.21	47	1.704	164.424
62.97.204.105	47	2.453	237.756
62.112.222.238	47	859	82.576
62.118.68.64	47	1.722	166.536
62.159.113.126	47	1.341	127.626
62.167.18.238	47	2.804	260.128
62.233.185.119	47	1.098	105.968
66.134.26.39	47	1.890	181.684
66.159.198.247	47	3.464	335.192
66.193.161.225	47	4.478	432.564
67.125.255.167	47	2.445	236.288
68.112.226.152	47	1.719	164.596
69.60.118.182	47	1.941	188.264
69.67.164.201	47	2.605	252.332
69.104.213.18	47	2.570	248.540
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80.53.126.251	47	2.594	249.072
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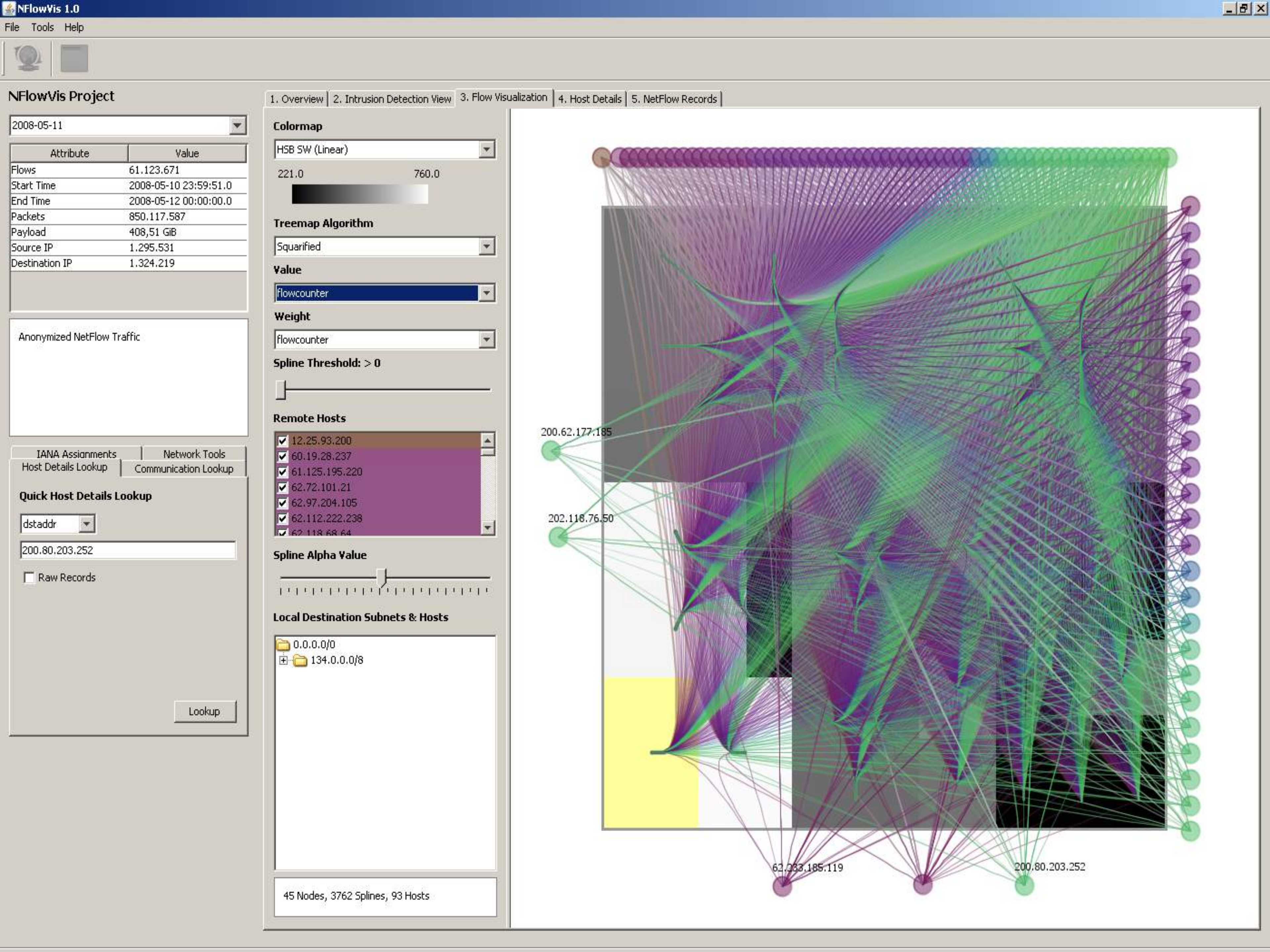
80.161.109.221	47	1.702	164.016
80.177.241.225	47	850	81.804
80.201.241.43	47	861	83.268
81.45.223.94	47	849	82.074
81.73.179.127	47	883	86.172
81.183.215.67	47	859	82.860
81.210.83.14	47	1.702	164.016
81.219.193.229	47	1.701	164.296
82.73.18.83	47	1.702	164.016
82.106.69.133	47	852	82.012
82.119.244.210	47	963	91.944
82.127.35.88	47	1.828	175.156
82.186.188.210	47	2.209	213.152

☑ Ignore single flow connections ☐ Include any traffic between hosts



NFlowVis Project

2008-05-11

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Start Time	2008-05-10 23:59:51.0
End Time	2008-05-12 00:00:00.0
Packets	850.117.587
Payload	408,51 GiB
Source IP	1.295.531
Destination IP	1.324.219

Anonymized NetFlow Traffic

Quick Host Details Lookup

dstaddr

200.80.203.252

☐ Raw Records

Colormap

HSB SW (Linear)

221.0 760.0

Treemap Algorithm

Squarified

Value

flowcounter

Weight

flowcounter

Spline Threshold: > 0

Remote Hosts

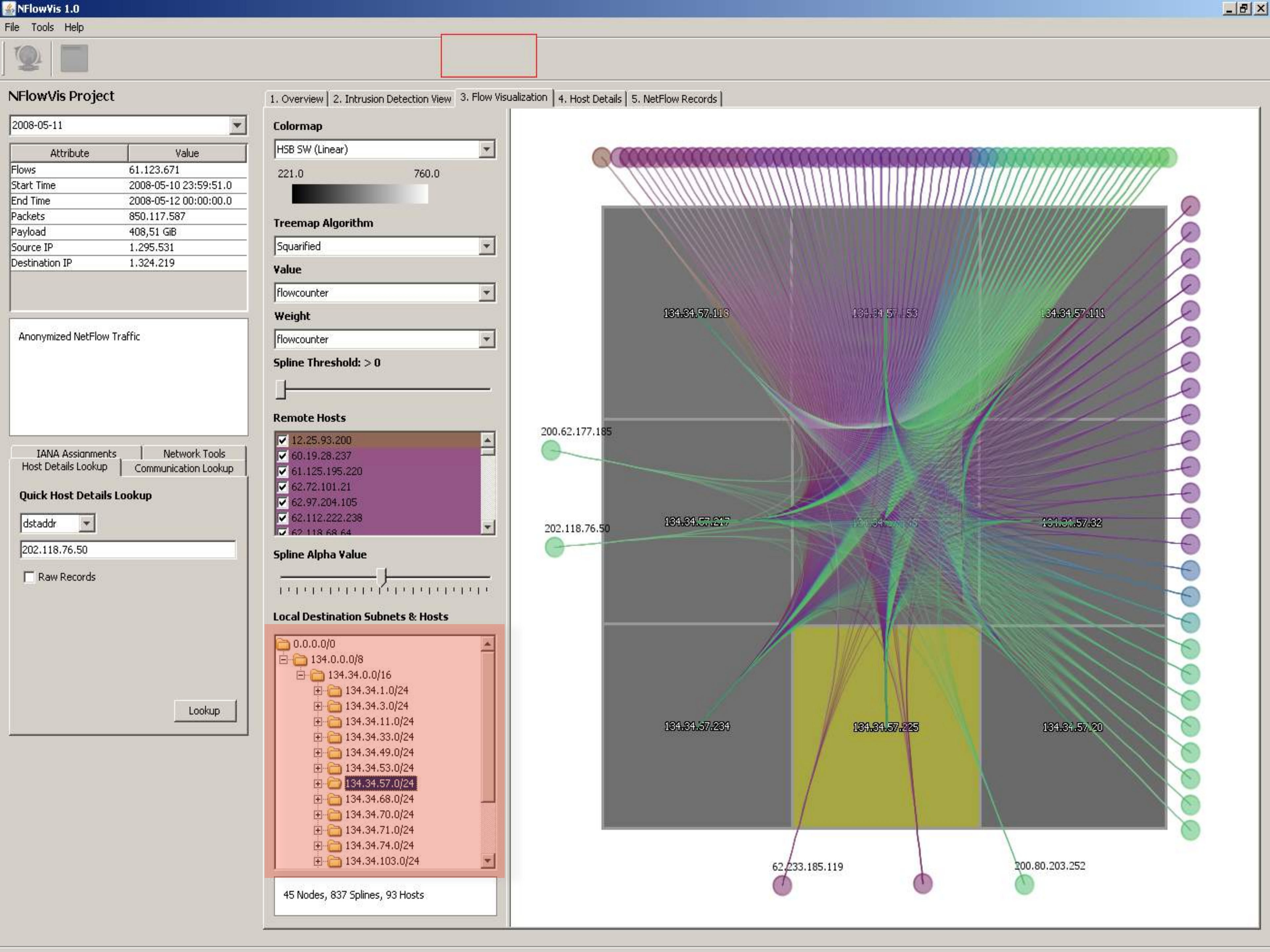
☑ 12.25.93.200
☑ 60.19.28.237
☑ 61.125.195.220
☑ 62.72.101.21
☑ 62.97.204.105
☑ 62.112.222.238
☑ 62.118.68.64

Spline Alpha Value

Local Destination Subnets & Hosts

0.0.0.0/0
⊞ 134.0.0.0/8

45 Nodes, 3762 Splines, 93 Hosts



NFlowVis Project

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Attribute	Value
Flows	61.123.671
Start Time	2008-05-10 23:59:51.0
End Time	2008-05-12 00:00:00.0
Packets	850.117.587
Payload	408,51 GiB
Source IP	1.295.531
Destination IP	1.324.219

Anonymized NetFlow Traffic

Quick Host Details Lookup

dstaddr

202.118.76.50

☐ Raw Records

Colormap

HSB SW (Linear)

221.0 760.0

Treemap Algorithm

Squarified

Value

flowcounter

Weight

flowcounter

Spline Threshold: > 0

Remote Hosts

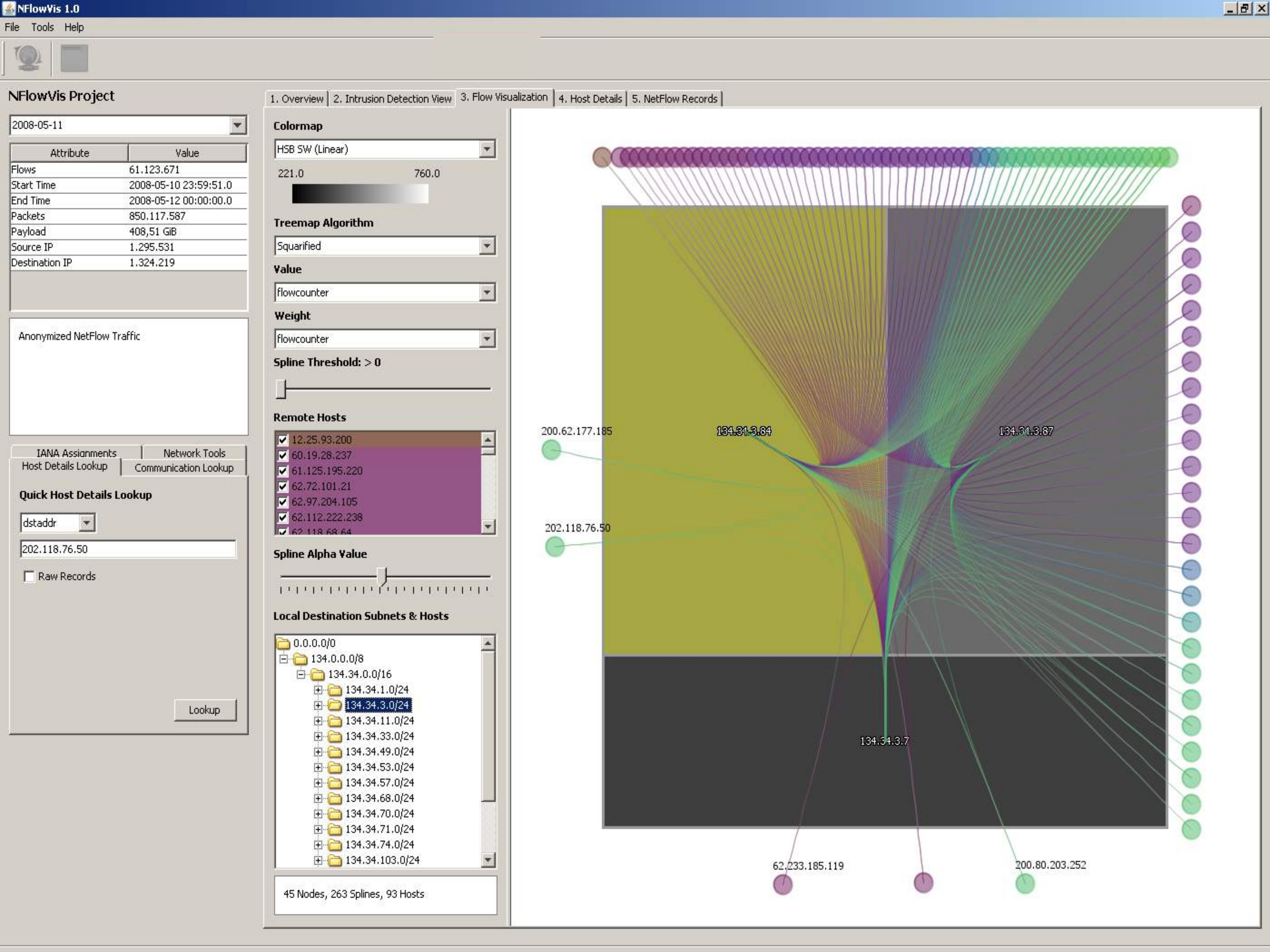
☑ 12.25.93.200
☑ 60.19.28.237
☑ 61.125.195.220
☑ 62.72.101.21
☑ 62.97.204.105
☑ 62.112.222.238
☑ 62.118.68.64

Spline Alpha Value

Local Destination Subnets & Hosts

```
0.0.0.0/0
  134.0.0.0/8
    134.34.0.0/16
      134.34.1.0/24
      134.34.3.0/24
      134.34.11.0/24
      134.34.33.0/24
      134.34.49.0/24
      134.34.53.0/24
      134.34.57.0/24
      134.34.68.0/24
      134.34.70.0/24
      134.34.71.0/24
      134.34.74.0/24
      134.34.103.0/24
```

45 Nodes, 837 Splines, 93 Hosts



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Anonymized NetFlow Traffic

Quick Host Details Lookup

dstaddr

202.118.76.50

□ Raw Records

Colormap

HSB SW (Linear)

221.0 760.0

Treemap Algorithm

Squarified

Value

flowcounter

Weight

flowcounter

Spline Threshold: > 0

Remote Hosts

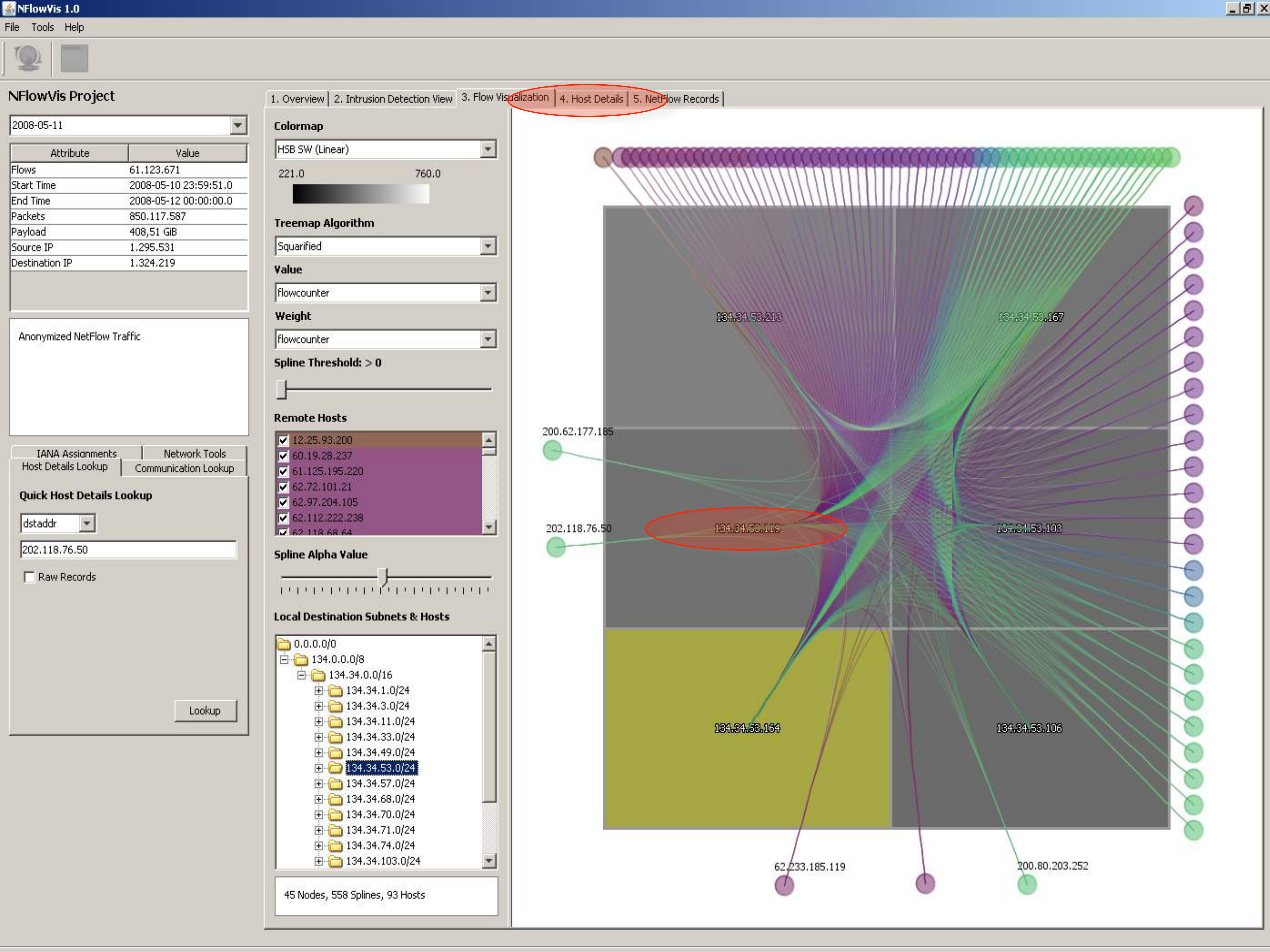
☑ 12.25.93.200
☑ 60.19.28.237
☑ 61.125.195.220
☑ 62.72.101.21
☑ 62.97.204.105
☑ 62.112.222.238
☑ 62.118.68.64

Spline Alpha Value

Local Destination Subnets & Hosts

- 0.0.0.0/0
  - 134.0.0.0/8
    - 134.34.0.0/16
      - 134.34.1.0/24
      - 134.34.3.0/24
      - 134.34.11.0/24
      - 134.34.33.0/24
      - 134.34.49.0/24
      - 134.34.53.0/24
      - 134.34.57.0/24
      - 134.34.68.0/24
      - 134.34.70.0/24
      - 134.34.71.0/24
      - 134.34.74.0/24
      - 134.34.103.0/24

45 Nodes, 263 Splines, 93 Hosts



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Quick Host Details Lookup

dstaddr

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□ Raw Records

Colormap

HSB SW (Linear)

221.0 760.0

Treemap Algorithm

Squarified

Value

flowcounter

Weight

flowcounter

Spline Threshold: > 0

Remote Hosts

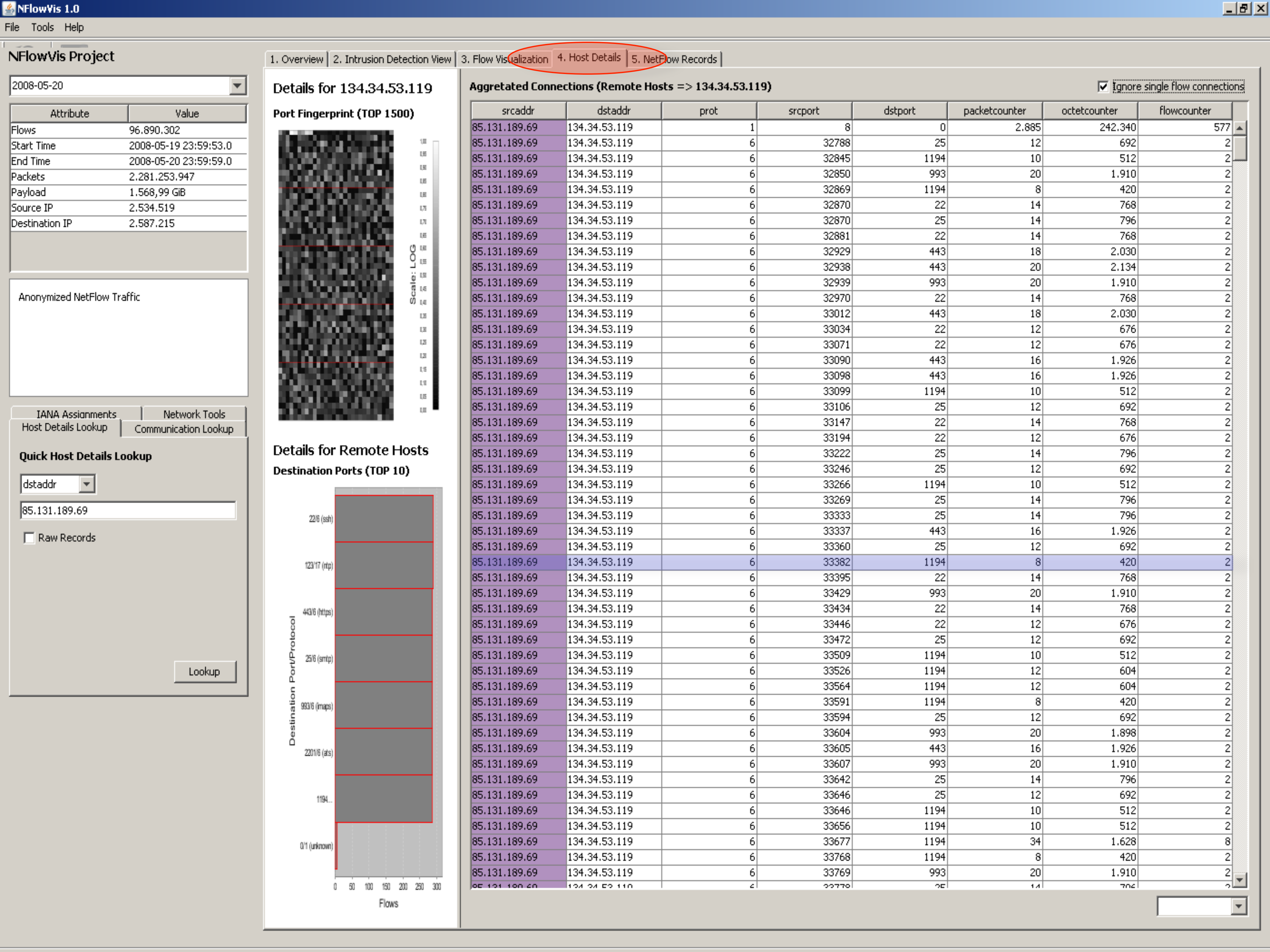
☑ 12.25.93.200
☑ 60.19.28.237
☑ 61.125.195.220
☑ 62.72.101.21
☑ 62.97.204.105
☑ 62.112.222.238
☑ 62.118.68.64

Spline Alpha Value

Local Destination Subnets & Hosts

- 0.0.0.0/0
  - 134.0.0.0/8
    - 134.34.0.0/16
      - 134.34.1.0/24
      - 134.34.3.0/24
      - 134.34.11.0/24
      - 134.34.33.0/24
      - 134.34.49.0/24
      - 134.34.53.0/24
      - 134.34.57.0/24
      - 134.34.68.0/24
      - 134.34.70.0/24
      - 134.34.71.0/24
      - 134.34.74.0/24
      - 134.34.103.0/24

45 Nodes, 558 Splines, 93 Hosts



NFlowVis Project

2008-05-20

Attribute	Value
Flows	96.890.302
Start Time	2008-05-19 23:59:53.0
End Time	2008-05-20 23:59:59.0
Packets	2.281.253.947
Payload	1.568,99 GiB
Source IP	2.534.519
Destination IP	2.587.215

Anonymized NetFlow Traffic

Quick Host Details Lookup

dstaddr

85.131.189.69

□ Raw Records

Details for 134.34.53.119

Port Fingerprint (TOP 1500)

Details for Remote Hosts

Destination Ports (TOP 10)

Aggretated Connections (Remote Hosts => 134.34.53.119)

☑ Ignore single flow connections

srcaddr	dstaddr	prot	srcport	dstport	packetcounter	octetcounter	flowcounter
85.131.189.69	134.34.53.119	1	8	0	2.885	242.340	577
85.131.189.69	134.34.53.119	6	32788	25	12	692	2
85.131.189.69	134.34.53.119	6	32845	1194	10	512	2
85.131.189.69	134.34.53.119	6	32850	993	20	1.910	2
85.131.189.69	134.34.53.119	6	32869	1194	8	420	2
85.131.189.69	134.34.53.119	6	32870	22	14	768	2
85.131.189.69	134.34.53.119	6	32870	25	14	796	2
85.131.189.69	134.34.53.119	6	32881	22	14	768	2
85.131.189.69	134.34.53.119	6	32929	443	18	2.030	2
85.131.189.69	134.34.53.119	6	32938	443	20	2.134	2
85.131.189.69	134.34.53.119	6	32939	993	20	1.910	2
85.131.189.69	134.34.53.119	6	32970	22	14	768	2
85.131.189.69	134.34.53.119	6	33012	443	18	2.030	2
85.131.189.69	134.34.53.119	6	33034	22	12	676	2
85.131.189.69	134.34.53.119	6	33071	22	12	676	2
85.131.189.69	134.34.53.119	6	33090	443	16	1.926	2
85.131.189.69	134.34.53.119	6	33098	443	16	1.926	2
85.131.189.69	134.34.53.119	6	33099	1194	10	512	2
85.131.189.69	134.34.53.119	6	33106	25	12	692	2
85.131.189.69	134.34.53.119	6	33147	22	14	768	2
85.131.189.69	134.34.53.119	6	33194	22	12	676	2
85.131.189.69	134.34.53.119	6	33222	25	14	796	2
85.131.189.69	134.34.53.119	6	33246	25	12	692	2
85.131.189.69	134.34.53.119	6	33266	1194	10	512	2
85.131.189.69	134.34.53.119	6	33269	25	14	796	2
85.131.189.69	134.34.53.119	6	33333	25	14	796	2
85.131.189.69	134.34.53.119	6	33337	443	16	1.926	2
85.131.189.69	134.34.53.119	6	33360	25	12	692	2
85.131.189.69	134.34.53.119	6	33382	1194	8	420	2
85.131.189.69	134.34.53.119	6	33395	22	14	768	2
85.131.189.69	134.34.53.119	6	33429	993	20	1.910	2
85.131.189.69	134.34.53.119	6	33434	22	14	768	2
85.131.189.69	134.34.53.119	6	33446	22	12	676	2
85.131.189.69	134.34.53.119	6	33472	25	12	692	2
85.131.189.69	134.34.53.119	6	33509	1194	10	512	2
85.131.189.69	134.34.53.119	6	33526	1194	12	604	2
85.131.189.69	134.34.53.119	6	33564	1194	12	604	2
85.131.189.69	134.34.53.119	6	33591	1194	8	420	2
85.131.189.69	134.34.53.119	6	33594	25	12	692	2
85.131.189.69	134.34.53.119	6	33604	993	20	1.898	2
85.131.189.69	134.34.53.119	6	33605	443	16	1.926	2
85.131.189.69	134.34.53.119	6	33607	993	20	1.910	2
85.131.189.69	134.34.53.119	6	33642	25	14	796	2
85.131.189.69	134.34.53.119	6	33646	25	12	692	2
85.131.189.69	134.34.53.119	6	33646	1194	10	512	2
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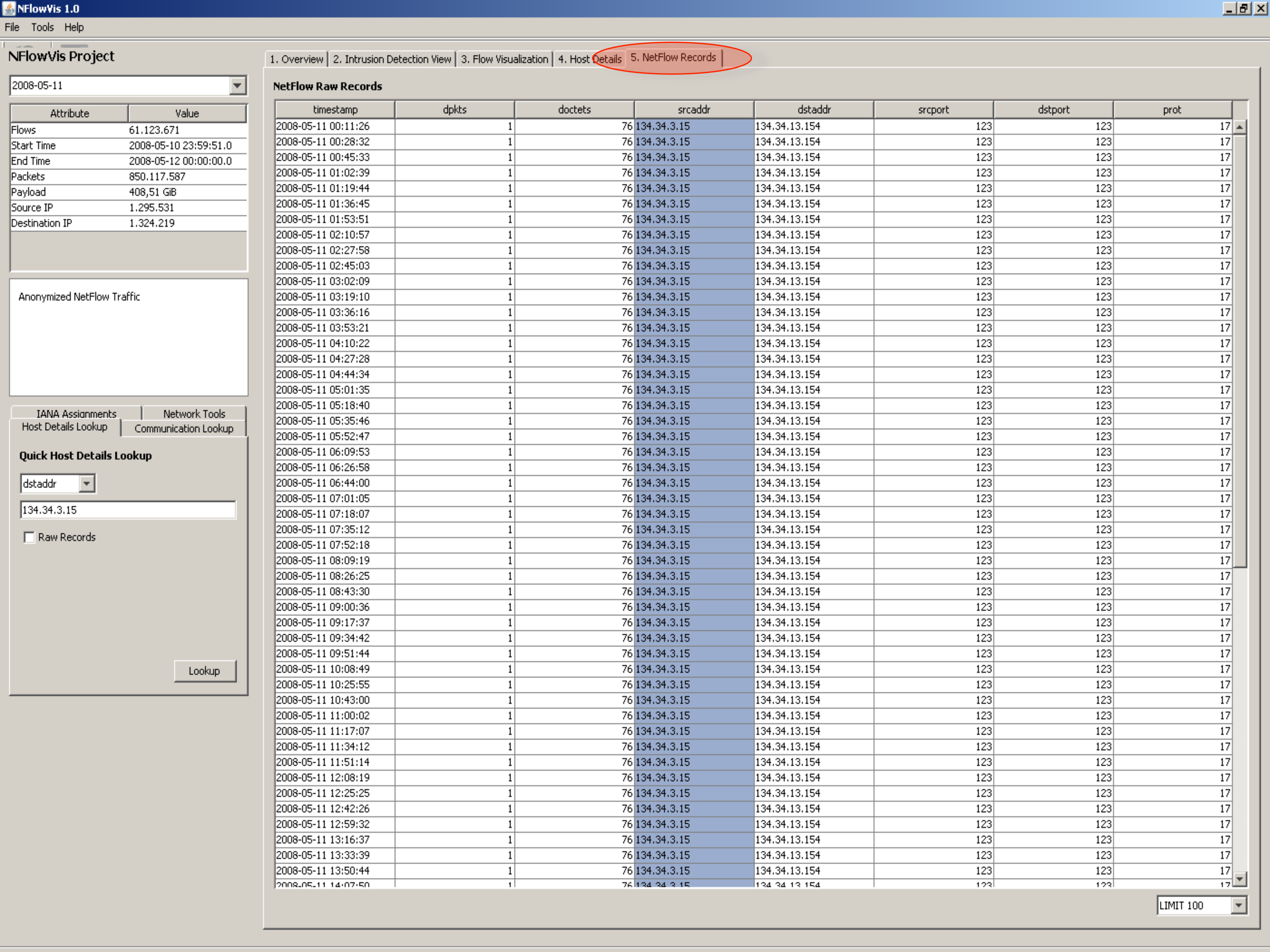

NFlowVis Project

2008-05-11

Attribute	Value
Flows	61.123.671
Start Time	2008-05-10 23:59:51.0
End Time	2008-05-12 00:00:00.0
Packets	850.117.587
Payload	408,51 GiB
Source IP	1.295.531
Destination IP	1.324.219

Anonymized NetFlow Traffic

Quick Host Details Lookup

dstaddr

134.34.3.15

☐ Raw Records

NetFlow Raw Records

timestamp	dpkts	doctets	srcaddr	dstaddr	srcport	dstport	prot
2008-05-11 00:11:26	1	76	134.34.3.15	134.34.13.154	123	123	17
2008-05-11 00:28:32	1	76	134.34.3.15	134.34.13.154	123	123	17
2008-05-11 00:45:33	1	76	134.34.3.15	134.34.13.154	123	123	17
2008-05-11 01:02:39	1	76	134.34.3.15	134.34.13.154	123	123	17
2008-05-11 01:19:44	1	76	134.34.3.15	134.34.13.154	123	123	17
2008-05-11 01:36:45	1	76	134.34.3.15	134.34.13.154	123	123	17
2008-05-11 01:53:51	1	76	134.34.3.15	134.34.13.154	123	123	17
2008-05-11 02:10:57	1	76	134.34.3.15	134.34.13.154	123	123	17
2008-05-11 02:27:58	1	76	134.34.3.15	134.34.13.154	123	123	17
2008-05-11 02:45:03	1	76	134.34.3.15	134.34.13.154	123	123	17
2008-05-11 03:02:09	1	76	134.34.3.15	134.34.13.154	123	123	17
2008-05-11 03:19:10	1	76	134.34.3.15	134.34.13.154	123	123	17
2008-05-11 03:36:16	1	76	134.34.3.15	134.34.13.154	123	123	17
2008-05-11 03:53:21	1	76	134.34.3.15	134.34.13.154	123	123	17
2008-05-11 04:10:22	1	76	134.34.3.15	134.34.13.154	123	123	17
2008-05-11 04:27:28	1	76	134.34.3.15	134.34.13.154	123	123	17
2008-05-11 04:44:34	1	76	134.34.3.15	134.34.13.154	123	123	17
2008-05-11 05:01:35	1	76	134.34.3.15	134.34.13.154	123	123	17
2008-05-11 05:18:40	1	76	134.34.3.15	134.34.13.154	123	123	17
2008-05-11 05:35:46	1	76	134.34.3.15	134.34.13.154	123	123	17
2008-05-11 05:52:47	1	76	134.34.3.15	134.34.13.154	123	123	17
2008-05-11 06:09:53	1	76	134.34.3.15	134.34.13.154	123	123	17
2008-05-11 06:26:58	1	76	134.34.3.15	134.34.13.154	123	123	17
2008-05-11 06:44:00	1	76	134.34.3.15	134.34.13.154	123	123	17
2008-05-11 07:01:05	1	76	134.34.3.15	134.34.13.154	123	123	17
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2008-05-11 07:35:12	1	76	134.34.3.15	134.34.13.154	123	123	17
2008-05-11 07:52:18	1	76	134.34.3.15	134.34.13.154	123	123	17
2008-05-11 08:09:19	1	76	134.34.3.15	134.34.13.154	123	123	17
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2008-05-11 09:34:42	1	76	134.34.3.15	134.34.13.154	123	123	17
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2008-05-11 10:08:49	1	76	134.34.3.15	134.34.13.154	123	123	17
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2008-05-11 11:00:02	1	76	134.34.3.15	134.34.13.154	123	123	17
2008-05-11 11:17:07	1	76	134.34.3.15	134.34.13.154	123	123	17
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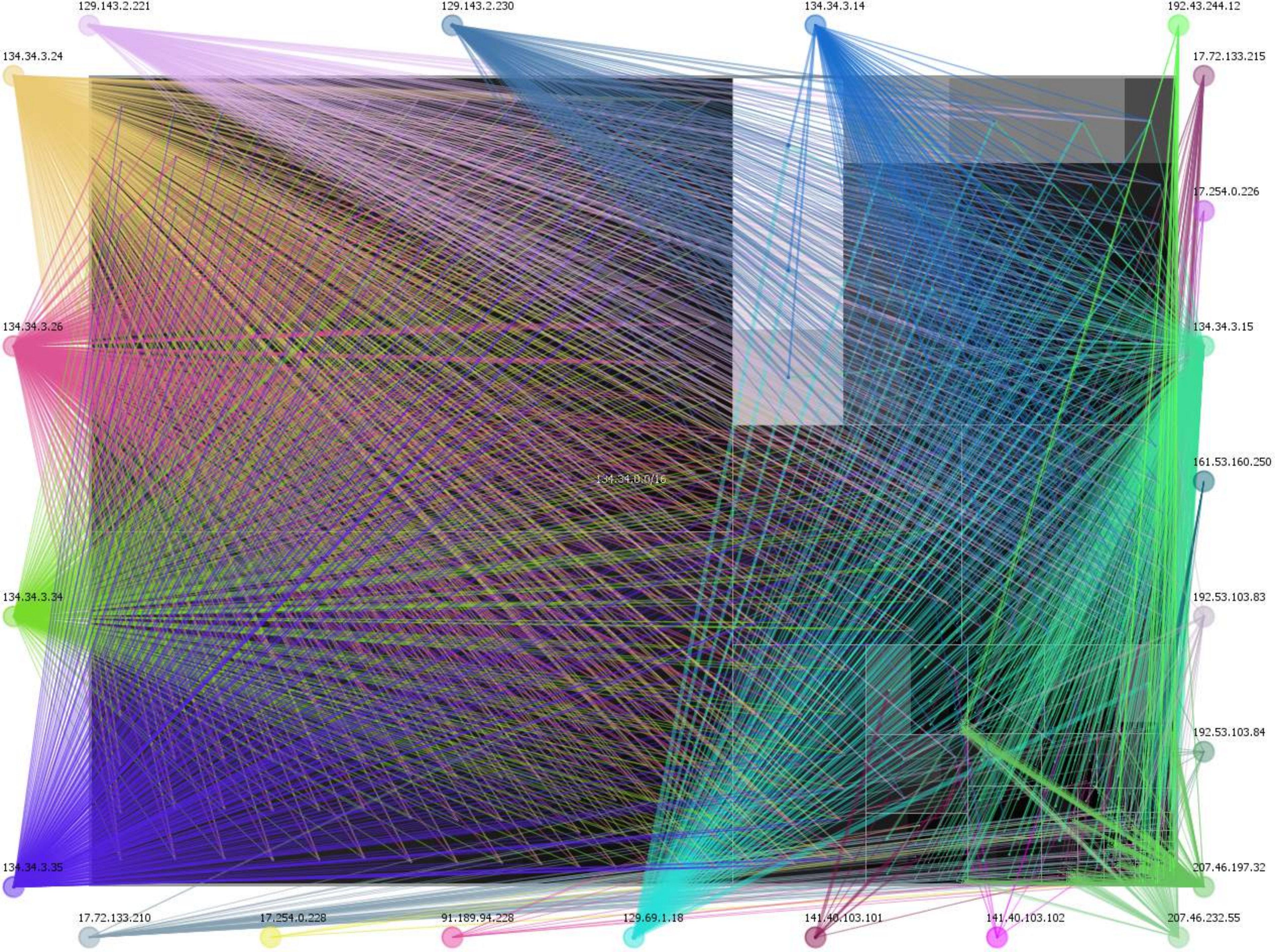
2008-05-11 11:51:14	1	76	134.34.3.15	134.34.13.154	123	123	17
2008-05-11 12:08:19	1	76	134.34.3.15	134.34.13.154	123	123	17
2008-05-11 12:25:25	1	76	134.34.3.15	134.34.13.154	123	123	17
2008-05-11 12:42:26	1	76	134.34.3.15	134.34.13.154	123	123	17
2008-05-11 12:59:32	1	76	134.34.3.15	134.34.13.154	123	123	17
2008-05-11 13:16:37	1	76	134.34.3.15	134.34.13.154	123	123	17
2008-05-11 13:33:39	1	76	134.34.3.15	134.34.13.154	123	123	17
2008-05-11 13:50:44	1	76	134.34.3.15	134.34.13.154	123	123	17
2008-05-11 14:07:50	1	76	134.34.3.15	134.34.13.154	123	123	17

LIMIT 100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17.72.133.215
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134.34.3.26
134.34.3.15
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134.34.3.34
192.53.103.83
192.53.103.84
134.34.3.35
207.46.197.32
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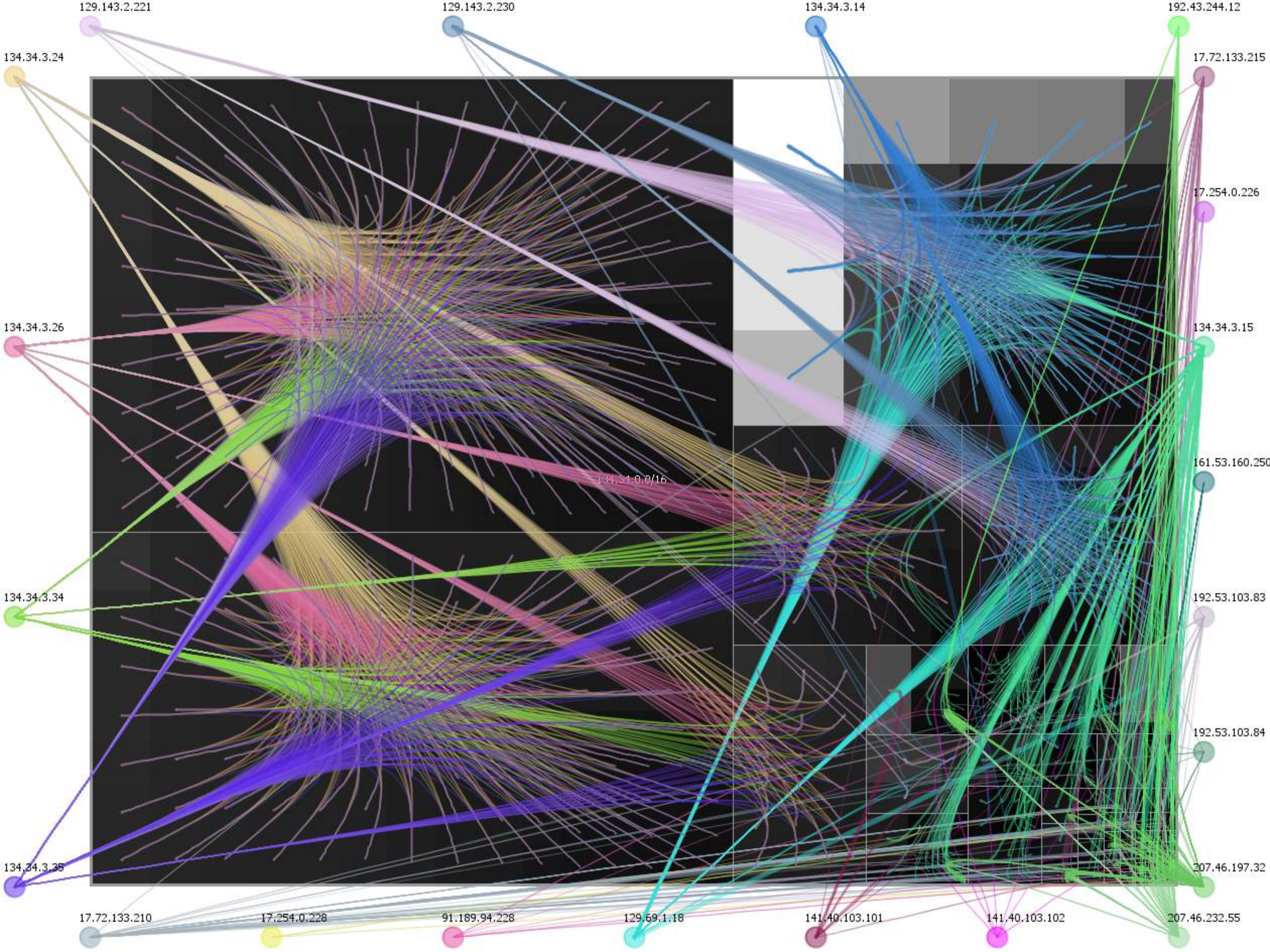
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134.34.3.26
134.34.3.15
134.34.0.0/16
161.53.160.250
134.34.3.34
192.53.103.83
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134.34.3.35
207.46.197.32
17.72.133.210
17.254.0.228
91.189.94.228
129.69.1.18
141.40.103.101
141.40.103.102
207.46.232.55

Thank you for your attention!

For further information about the tool please contact

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[2] Shneiderman, B.: Tree visualization with tree-maps: 2-d space-filling approach. ACM Trans. Graph. 11(1) (1992) 92–99