

Visual Traceroute (VTrace)

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Introduction

Visual Traceroute is a new feature that can be accessed by calling `reflector.cgi` with `function=vtrace`. Currently it can provide visual traceroute from 29 landmarks (2 in USA and 1 per each of 27 countries). Some of these are listed below, for a complete list check the [from dropdown](#):

1. www-wanmon.slac.stanford.edu, SLAC National Accelerator Lab, near San Francisco, California, USA
2. pinger.cern.ch, CERN, Geneva Switzerland
3. maggie1.seecs.edu.pk, National University of Science and Technology, Islamabad, Pakistan
4. mel-a-ext1.aarnet.net.au, Australia's Academic and Research Network, Melbourne, Australia
5. pinger.fsktm.um.edu.my, University of Malaya, Kuala Lumpur, Malaysia
6. lbnet-test.lbl.gov(131.243.24.12), LBL, Berkeley, California, USA

It works by first finding the traceroute to the target using the [traceroute.pl](#) installed at the landmark node and then geolocating each of the intermediate hop routers using [TULIP](#). It can be accessed from <http://tulip.slac.stanford.edu> or [here](#).

We use TULIP's dynamic ping-based geolocation as compared to say database methods such as used by [MaxMind](#) derived tools like [GeoIPTools](#), since often router locations in the database tend to be given as at the corporate HQ that owns the routers (e.g. ESnet routers may supposedly be located in Berkeley).

Performance

Normally it would take about 10 mins to perform a complete visual traceroute but we have incorporated caching to speed up the process. As the router locations are found they are automatically cached in `/nfs/slac/g/net/pinger/tulip/cachetr/cache.txt`

If the location of all the routers in the requested vtrace are cached then it takes only about 10 secs to give the output.

Working Specifics

A subset of the [Maxmind city database](#) is used to find the nearest city to each router, only cities with population greater than 100,000 are considered.

- The database used is `/nfs/slac/g/net/pinger/tulip/citidb.txt`

Both PingER and PerfSONAR landmarks can be used as the traceroute source

- List of possible PingER landmarks is `/nfs/slac/g/net/pinger/tulip/pinger_vtrace.txt`
- List of possible PerfSONAR landmarks is `/nfs/slac/g/net/pinger/tulip/psonar_vtrace.txt`
- or simply see <http://www-wanmon.slac.stanford.edu/cgi-wrap/reflector.cgi?PE=set&PSE=set&function=landmarks>

Visual Traceroute can be called directly from URL. The format is:

- `http://www-wanmon.slac.stanford.edu/cgi-bin/reflector.cgi?function=vtrace&from=Landmark_HostName&target=target_IP_or_HostName`
- for `Landmark_HostName` see <http://www-wanmon.slac.stanford.edu/cgi-wrap/reflector.cgi?function=landmarks> in some cases the `HostName` is the same as IP

The From landmarks drop down list is populated from `/nfs/slac/g/net/pinger/tulip/from.txt`. This list is checked and updated daily from crontab using `vtracefromchk.pl`

Certain routers can not be geolocated because they respond to only a few pings or don't respond to them at all. A script `vtrace0chk.pl` tries to geolocate such routers in the cache and updates the cache accordingly each night.

Both `vtracefromchk.pl` and `vtrace0chk.pl` are placed in `/afs/slac/package/pinger/tulip/` and executed via `trscrontab` in `pinger.slac.stanford.edu` for user `pinger`.

Design

The tabular traceroute is shown together with the Autonomous System Number (ASN), if known, the router's location coordinates and distance between hops. Clicking on the IP address will take you to the TULIP geolocation utility. Clicking on the ASN will provide information on the ASN.

Two traceroute paths are shown on the google map. One (shown in red) is drawn using TULIP and the other (shown in blue) is drawn using MaxMind (an IP host location database). The hops are shown as appropriate numbered markers, the error in the estimated location is shown as a red circle. See the figure below:

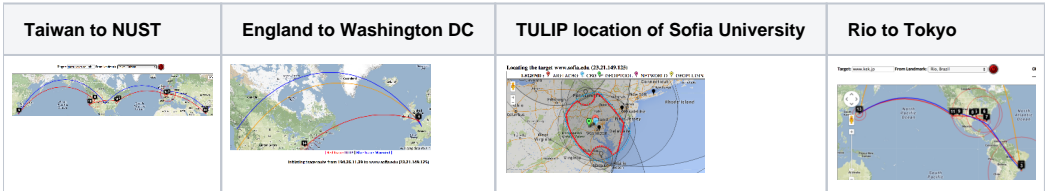
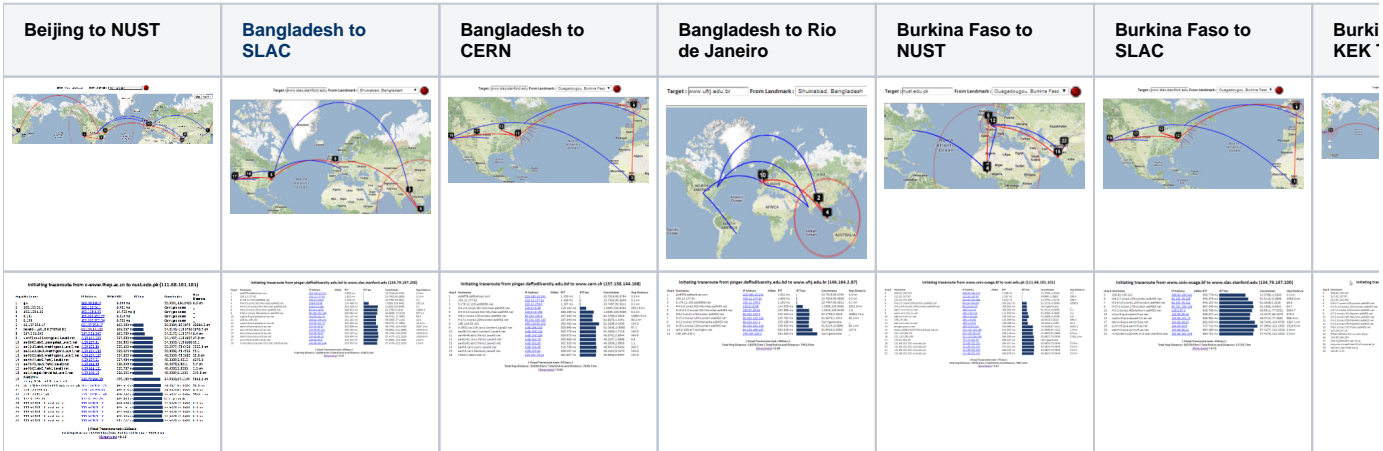
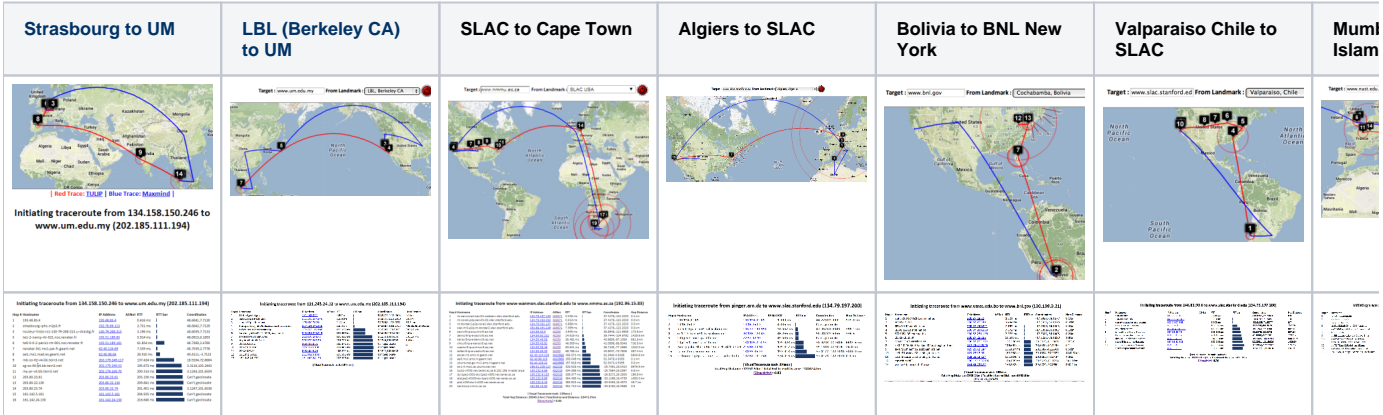
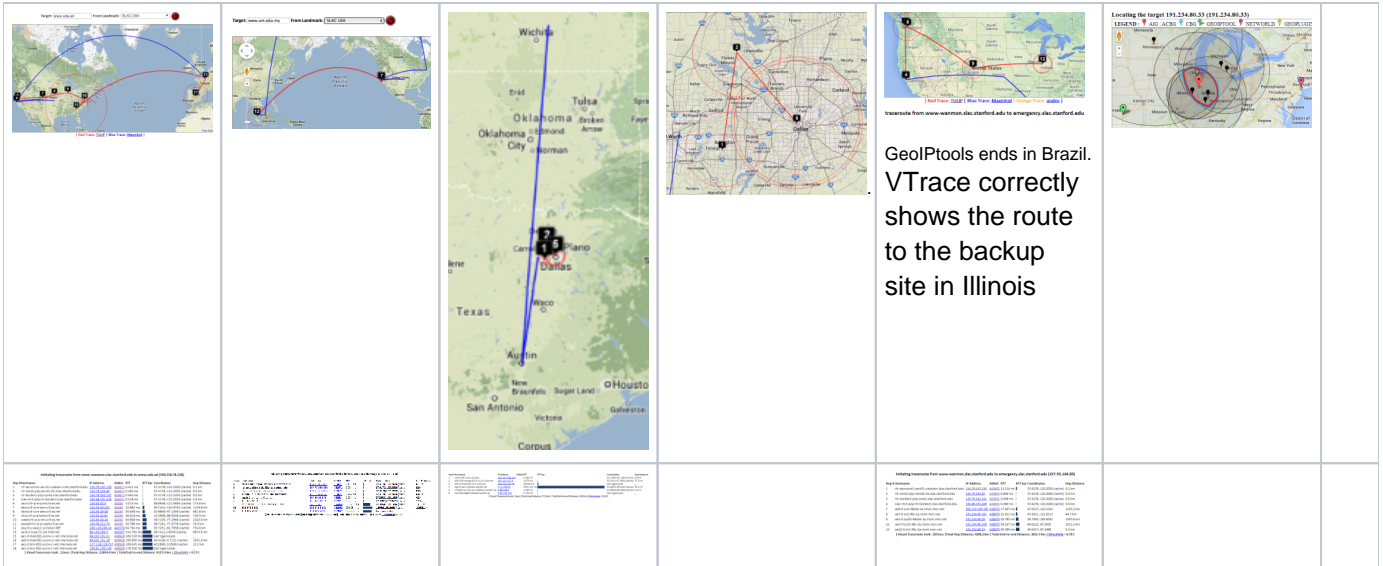


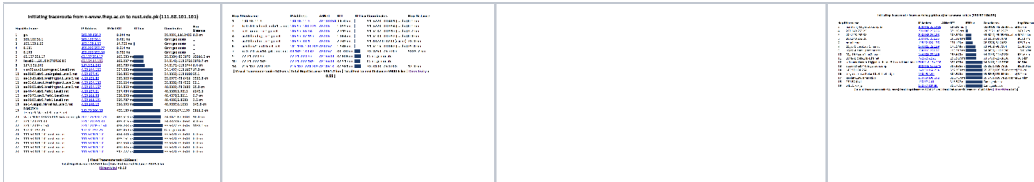
This figure shows the traceroute from SLAC to NUST Pakistan. <http://www-wanmon.slac.stanford.edu/cgi-wrap/reflector.cgi?function=vtrace&target=nust.edu.pk>

Comparisons between MaxMind and TULIP

This presentation was sent to Harvey.

University of Malaya, Kuala Lumpur to NUST Islamabad	NUST Islamabad to University of Malaya	CERN to NUST	Melbourne to NUST	Melbourne to CERN	Melbourne to SLAC	CERN to SLAC
<div>Target : nust.edu.pk From : UM Malaysia</div>	<div>Target : nust.edu.pk From : SECS Pakistan</div>	<div>Target : nust.edu.pk From : CERN</div>	<div>Target : nust.edu.pk From : Melbourne Australia</div>	<div>Target : www.cern.ch From : Melbourne Australia</div>	<div>Target : nust.edu.pk From : Melbourne Australia</div>	<div>Target : www.cern.ch From : Melbourne Australia</div>
SLAC to CERN	SLAC to ICTP Trieste	SLAC to NUST	SLAC to UCSD	SLAC to Melbourne	SLAC to Waikato New Zealand	SLAC to Cambridge
<div>Target : www.cern.ch From : SLAC USA</div>	<div>Target : www.ictp.it From : SLAC USA</div>	<div>Target : www.nust.edu.pk From : SLAC USA</div>	<div>Target : www.ucsd.edu From : SLAC USA</div>	<div>Target : www.slac.stanford.edu From : SLAC USA</div>	<div>Target : www.waikato.ac.nz From : SLAC USA</div>	<div>Target : www.cam.ac.uk From : SLAC USA</div>
SLAC to Andora	SLAC to Malaysia	Dallas to Dallas	Dallas to Dallas detail	SLAC to emergency.slac.stanford.edu	Detail on emergency	
<div>Target : www.andorra.gov From : SLAC USA</div>	<div>Target : www.malaysia.gov From : SLAC USA</div>	<div>Target : www.dallas.gov From : SLAC USA</div>	<div>Target : www.dallas.gov From : SLAC USA</div>	<div>Target : www.slac.stanford.edu From : SLAC USA</div>	<div>Target : www.slac.stanford.edu From : SLAC USA</div>	





The England to Washington DC is interesting since VTrace, Maxmind and undns (orange line) give very different results for the target. Despite [Sofia University](#) advertising itself as being in Palo Alto the web server is actually near Washington DC. Also the route does not go from London to Paris as indicated by Maxmind.

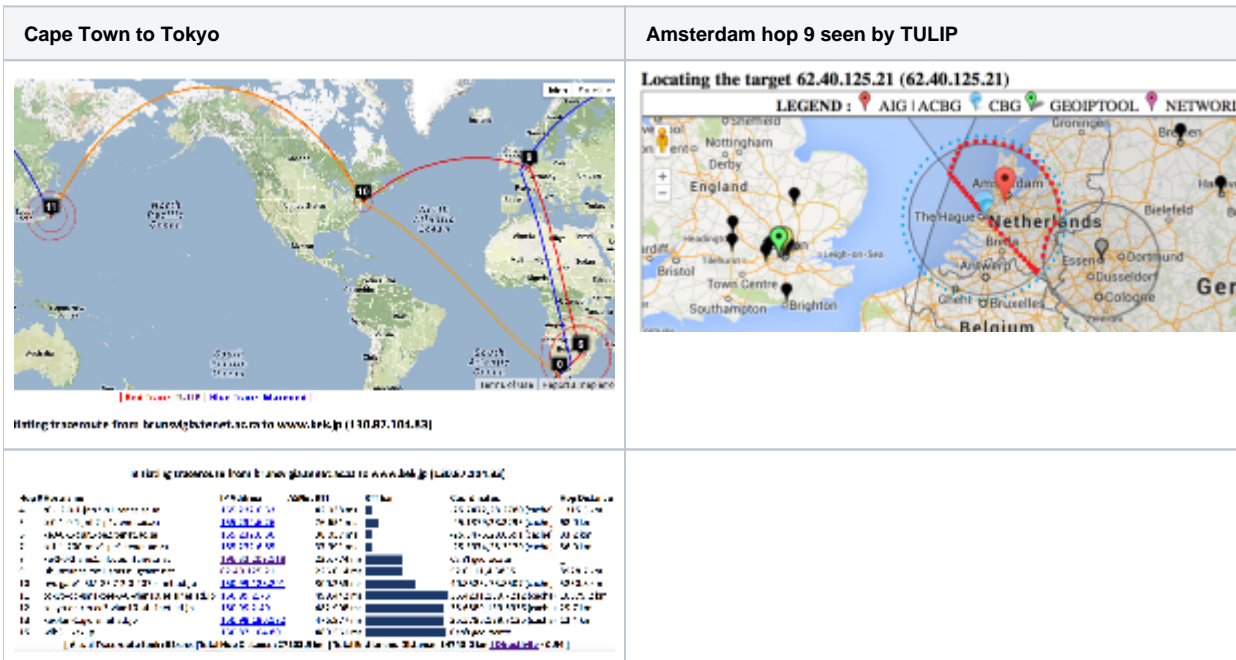
Complementarity of VTrace and MaxMind

SLAC to Portugal



By providing both VTrace (red) and Maxmind (blue) routes, the results can be complementary in ascertaining the correct route. This is illustrated in the plots below from SLAC to a host in Braga Portugal (193.136.19.13). The left hand map shows how VTrace accurately traces the route across the US, while Maxmind jumps from SLAC to the middle of the US, back to Berkeley and thence to Europe. This is shown in more detail in the W. Coast US map. Moving further right, Vtrace shows the route through the Netherlands and the UK, while Maxmind misses the Netherlands altogether. The Portugal detail indicates that Maxmind is more accurate in showing the final route to Braga. However, note that the Vtrace accuracy circles indicate the considerable uncertainty in the location of the last hop, hence improving one's confidence. The traceroute figure which indicates that hops 12 and 13 are likely to be in the Netherlands and the UK given their naming conventions (note the top level domains .nl and .uk in the names). The TULIP plot shows how the paucity of nearby landmarks (black market balloons) results in the poor geolocation of the Braga site.

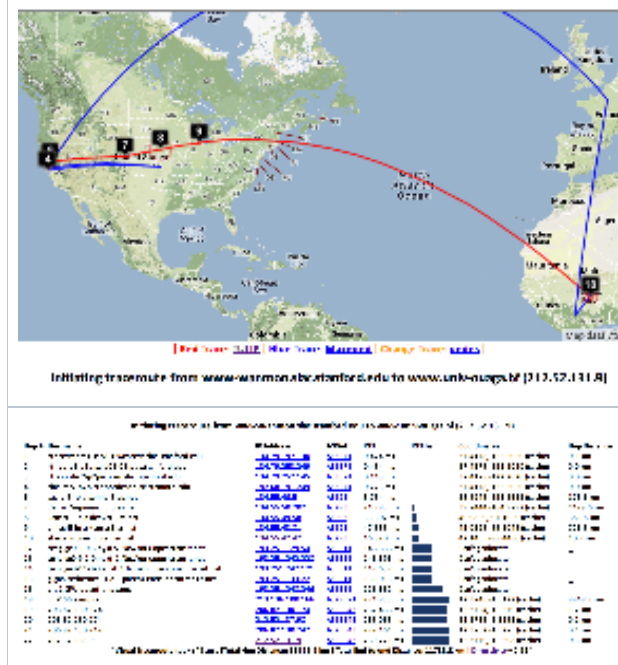
Cape Town to Tokyo



Maxmind catches hop (8) in Europe (but gets hops 8 and 9 in London rather than Amsterdam) that VTrace (hop 8 does not respond to pings) misses and undns (orange line) misses both hops 8 and 9. VTrace catches the Johannesburg hop (4), and Pretoria hops (5) that undns and Maxmind miss. VTrace and undns catch the New York hop (10) that Maxmind misses.

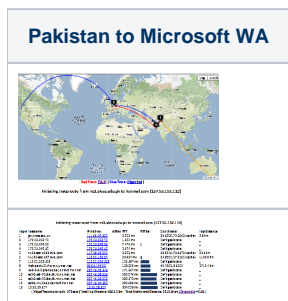
SLAC to Burkina Faso

SLAC to Burkina Faso



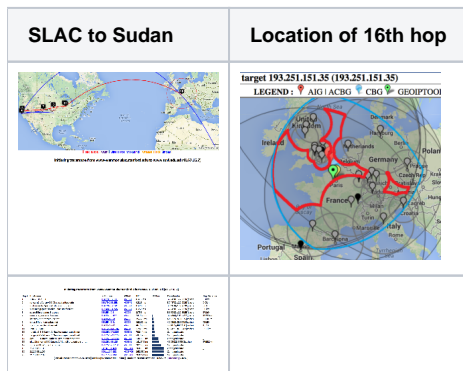
Maxmind gets the location of the hops in France, but does not do well in the US.

Pakistan to Washington State



For the Pakistan to hotmail.com (Microsoft WA) undns gets off track and goes to Australia. VTrace correctly gets hop 6 as being in Karachi (while Maxmind puts it in the middle of Pakistan), however VTrace loses track after getting to Frankfurt Germany (since hops 9-13 do not respond to pings), while Maxmind gets the end destination as being Microsoft's home of Redmond Washington.

SLAC to Sudan



VTrace gets the route across the US and to France, but not the last hops to Sudan. DeoIPTools gets Sudan as the final destination.

Melbourne to French Polynesia

Melbourne to French Polynesia

Detail for Australia

Detail of VTrace & undns at Melbourne

Detail of W. Coast US

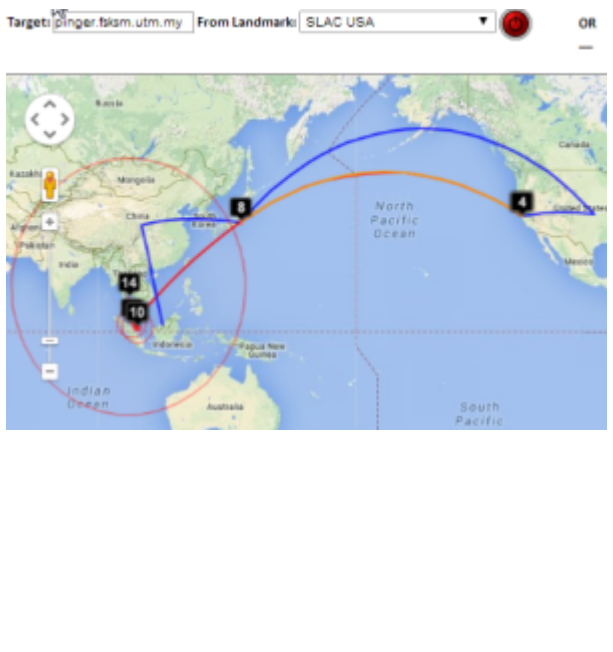
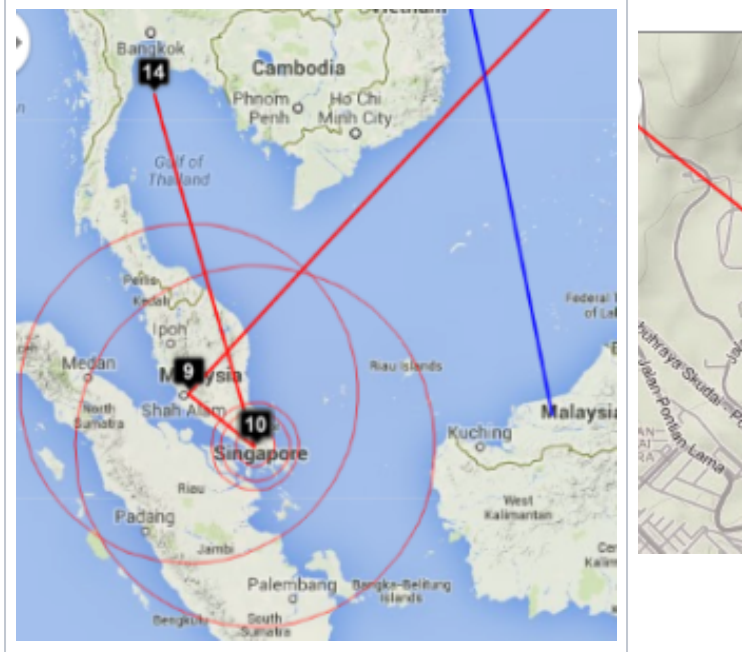
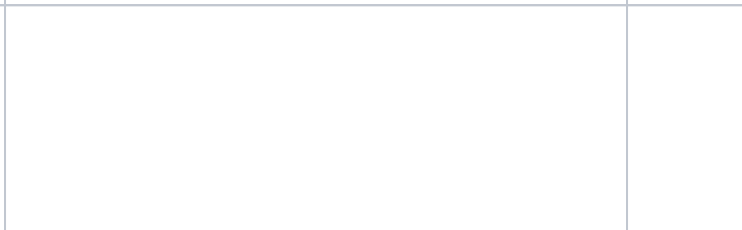
Detail showing VTrace & undns at Seattle

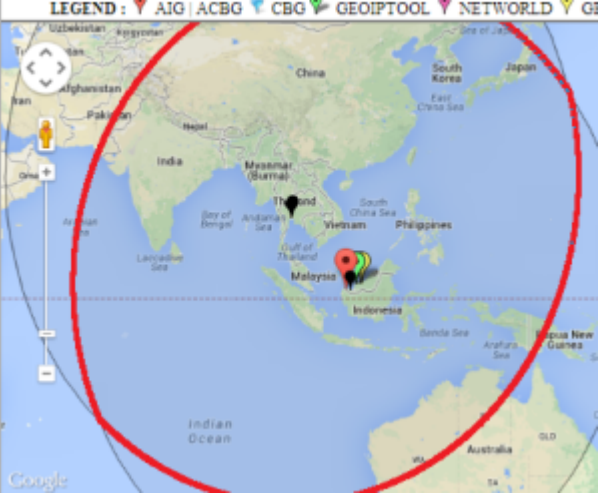
Malaysia to French Polynesia

Japan to Polyn

Red Trace: [1] [2] [3] [4] [5] [6] [7] [8] [9] [10] [11] [12] [13] [14] [15] [16] [17] [18] [19] [20] [21] [22] [23] [24] [25] [26] [27] [28] [29] [30] [31] [32] [33] [34] [35] [36] [37] [38] [39] [40] [41] [42] [43] [44] [45] [46] [47] [48] [49] [50] [51] [52] [53] [54] [55] [56] [57] [58] [59] [60] [61] [62] [63] [64] [65] [66] [67] [68] [69] [70] [71] [72] [73] [74] [75] [76] [77] [78] [79] [80] [81] [82] [83] [84] [85] [86] [87] [88] [89] [90] [91] [92] [93] [94] [95] [96] [97] [98] [99] [100] [101] [102] [103] [104] [105] [106] [107] [108] [109] [110] [111] [112] [113] [114] [115] [116] [117] [118] [119] [120] [121] [122] [123] [124] [125] [126] [127] [128] [129] [130] [131] [132] [133] [134] [135] [136] [137] [138] [139] [140] [141] [142] [143] [144] [145] [146] [147] [148] [149] [150] [151] [152] [153] [154] [155] [156] [157] [158] [159] [160] [161] [162] [163] [164] [165] [166] [167] [168] [169] [170] [171] [172] [173] [174] [175] [176] [177] [178] [179] [180] [181] [182] [183] [184] [185] [186] [187] [188] [189] [190] [191] [192] [193] [194] [195] [196] [197] [198] [199] [200] [201] [202] [203] [204] [205] [206] [207] [208] [209] [210] [211] [212] [213] [214] [215] [216] [217] [218] [219] [220] [221] [222] [223] [224] [225] [226] [227] [228] [229] [230] [231] [232] [233] [234] [235] [236] [237] [238] [239] [240] [241] [242] [243] [244] [245] [246] [247] [248] [249] [250] [251] [252] [253] [254] [255] [256] [257] [258] [259] [260] [261] [262] [263] [264] [265] [266] [267] [268] [269] [270] [271] [272] [273] [274] [275] [276] [277] [278] [279] [280] [281] [282] [283] [284] [285] [286] [287] [288] [289] [290] [291] [292] [293] [294] [295] [296] [297] [298] [299] [300] [301] [302] [303] [304] [305] [306] [307] [308] [309] [310] [311] [312] [313] [314] [315] [316] [317] [318] [319] [320] [321] [322] [323] [324] [325] [326] [327] [328] [329] [330] [331] [332] [333] [334] [335] [336] [337] [338] [339] [340] [341] [342] [343] [344] [345] [346] [347] [348] [349] [350] [351] [352] [353] [354] [355] [356] [357] [358] [359] [360] [361] [362] [363] [364] [365] [366] [367] [368] [369] [370] [371] [372] [373] [374] [375] [376] [377] [378] [379] [380] [381] [382] [383] [384] [385] [386] [387] [388] [389] [390] [391] [392] [393] [394] [395] [396] [397] [398] [399] [400] [401] [402] [403] [404] [405] [406] [407] [408] [409] [410] [411] [412] [413] [414] [415] [416] [417] [418] [419] [420] [421] [422] [423] [424] [425] [426] [427] [428] [429] [430] [431] [432] [433] [434] [435] [436] [437] [438] [439] [440] [441] [442] [443] [444] [445] [446] [447] [448] [449] [450] [451] [452] [453] [454] [455] [456] [457] [458] [459] [460] [461] [462] [463] [464] [465] [466] [467] [468] [469] [470] [471] [472] [473] [474] [475] [476] [477] [478] [479] [480] [481] [482] [483] [484] [485] [486] [487] [488] [489] [490] [491] [492] [493] [494] [495] [496] [497] [498] [499] [500] [501] [502] [503] [504] [505] [506] [507] [508] [509] [510] [511] [512] [513] [514] [515] [516] [517] [518] [519] [520] [521] [522] [523] [524] [525] [526] [527] [528] [529] [530] [531] [532] [533] [534] [535] [536] [537] [538] [539] [540] [541] [542] [543] [544] [545] [546] [547] [548] [549] [550] [551] [552] [553] [554] [555] [556] [557] [558] [559] [560] [561] [562] [563] [564] [565] [566] [567] [568] [569] [570] [571] [572] [573] [574] [575] [576] [577] [578] [579] [580] [581] [582] [583] [584] [585] [586] [587] [588] [589] [590] [591] [592] [593] [594] [595] [596] [597] [598] [599] [600] [601] [602] [603] [604] [605] [606] [607] [608] [609] [610] [611] [612] [613] [614] [615] [616] [617] [618] [619] [620] [621] [622] [623] [624] [625] [626] [627] [628] [629] [630] [631] [632] [633] [634] [635] [636] [637] [638] [639] [640] [641] [642] [643] [644] [645] [646] [647] [648] [649] [650] [651] [652] [653] [654] [655] [656] [657] [658] [659] [660] [661] [662] [663] [664] [665] [666] [667] [668] [669] [670] [671] [672] [673] [674] [675] [676] [677] [678] [679] [680] [681] [682] [683] [684] [685] [686] [687] [688] [689] [690] [691] [692] [693] [694] [695] [696] [697] [698] [699] [700] [701] [702] [703] [704] [705] [706] [707] [708] [709] [710] [711] [712] [713] [714] [715] [716] [717] [718] [719] [720] [721] [722] [723] [724] [725] [726] [727] [728] [729] [730] [731] [732] [733] [734] [735] [736] [737] [738] [739] [740] [741] [742] [743] [744] [745] [746] [747] [748] [749] [750] [751] [752] [753] [754] [755] [756] [757] [758] [759] [760] [761] [762] [763] [764] [765] [766] [767] [768] [769] [770] [771] [772] [773] [774] [775] [776] [777] [778] [779] [780] [781] [782] [783] [

Miscellaneous


<p>Global view of SLAC to UTM, Johor Bahru, Malaysia</p>	<p>E. Asia part of route</p> <p>Last few hops</p>																																																																																																																														
																																																																																																																															
<p>Initiating traceroute from www-wsnet.slac.stanford.edu to pinger.fkism.utm.my [161.139.68.188]</p> <table> <tr> <th>Hop</th><th>#</th><th>Hostname</th><th>IP Address</th><th>ASNet</th><th>RTT</th><th>RTT Var</th><th>Coordinates</th><th>Hop Distance</th></tr> <tr> <td>1</td><td>184.79.187.132</td><td></td><td>184.79.187.132</td><td>AS16271</td><td>0.484 ms</td><td></td><td>37.4178, 122.2020 (jache)</td><td>0.1 km</td></tr> <tr> <td>2</td><td>rtt-mra2-e2p-aen03-05.slac.stanford.edu</td><td></td><td>134.79.234.85</td><td>AS16271</td><td>0.515 ms</td><td></td><td>37.4178, 122.2020 (jache)</td><td>0.0 km</td></tr> <tr> <td>3</td><td>rtt-border1-e2p-core2.slac.stanford.edu</td><td></td><td>134.79.253.127</td><td>AS16271</td><td>0.416 ms</td><td></td><td>37.4178, 122.2020 (jache)</td><td>0.0 km</td></tr> <tr> <td>4</td><td>slac-mv2-gig-rtt-border1.slac.stanford.edu</td><td></td><td>152.68.159.45</td><td>AS16271</td><td>0.154 ms</td><td></td><td>37.4178, 122.2020 (jache)</td><td>0.0 km</td></tr> <tr> <td>5</td><td>core-do-gig1-vax2-3-1-4005.jpaplanet.net</td><td></td><td>203.181.148.148</td><td>AS17682</td><td>124.096 ms</td><td></td><td>35.6885, 139.6940 (jache)</td><td>832.5 km</td></tr> <tr> <td>6</td><td>igw-e2-v2-ak1-16139.slac.stanford.edu</td><td></td><td>202.179.249.77</td><td>AS16480</td><td>182.820 ms</td><td></td><td>3.1188, 101.8870 (jache)</td><td>8381.4 km</td></tr> <tr> <td>7</td><td>202.179.249.86</td><td></td><td>202.179.249.86</td><td>AS16480</td><td>198.954 ms</td><td></td><td>1.5549, 103.8418 (jache)</td><td>280.5 km</td></tr> <tr> <td>8</td><td>202.179.249.86</td><td></td><td>202.80.21.141</td><td>AS24514</td><td>108.974 ms</td><td></td><td>Can't geolocate</td><td>-</td></tr> <tr> <td>9</td><td>202.179.249.86</td><td></td><td>202.80.21.138</td><td>AS24514</td><td>120.197 ms</td><td></td><td>Can't geolocate</td><td>-</td></tr> <tr> <td>10</td><td>202.179.249.86</td><td></td><td>202.80.21.141</td><td>AS24514</td><td>106.837 ms</td><td></td><td>1.5502, 103.8414 (jache)</td><td>0.2 km</td></tr> <tr> <td>11</td><td>161.139.246.9</td><td></td><td>161.139.246.9</td><td>AS16242</td><td>206.809 ms</td><td></td><td>11.9721, 105.8143 (jache)</td><td>1206.6 km</td></tr> <tr> <td>12</td><td>161.139.246.129</td><td></td><td>161.139.246.129</td><td>AS16242</td><td>207.793 ms</td><td></td><td>1.5502, 103.8414 (jache)</td><td>1206.5 km</td></tr> <tr> <td>13</td><td>161.139.246.129</td><td></td><td>161.139.246.129</td><td>AS16242</td><td>205.464 ms</td><td></td><td>1.5500, 103.8440 (jache)</td><td>0.6 km</td></tr> </table> <p>[Visual Traceroute tool : dfaeze [Total Hop Distance: 16344.3 km Total End-to-end Distances: 13633.9 km Link Quality = 0.83]</p>	Hop	#	Hostname	IP Address	ASNet	RTT	RTT Var	Coordinates	Hop Distance	1	184.79.187.132		184.79.187.132	AS16271	0.484 ms		37.4178, 122.2020 (jache)	0.1 km	2	rtt-mra2-e2p-aen03-05.slac.stanford.edu		134.79.234.85	AS16271	0.515 ms		37.4178, 122.2020 (jache)	0.0 km	3	rtt-border1-e2p-core2.slac.stanford.edu		134.79.253.127	AS16271	0.416 ms		37.4178, 122.2020 (jache)	0.0 km	4	slac-mv2-gig-rtt-border1.slac.stanford.edu		152.68.159.45	AS16271	0.154 ms		37.4178, 122.2020 (jache)	0.0 km	5	core-do-gig1-vax2-3-1-4005.jpaplanet.net		203.181.148.148	AS17682	124.096 ms		35.6885, 139.6940 (jache)	832.5 km	6	igw-e2-v2-ak1-16139.slac.stanford.edu		202.179.249.77	AS16480	182.820 ms		3.1188, 101.8870 (jache)	8381.4 km	7	202.179.249.86		202.179.249.86	AS16480	198.954 ms		1.5549, 103.8418 (jache)	280.5 km	8	202.179.249.86		202.80.21.141	AS24514	108.974 ms		Can't geolocate	-	9	202.179.249.86		202.80.21.138	AS24514	120.197 ms		Can't geolocate	-	10	202.179.249.86		202.80.21.141	AS24514	106.837 ms		1.5502, 103.8414 (jache)	0.2 km	11	161.139.246.9		161.139.246.9	AS16242	206.809 ms		11.9721, 105.8143 (jache)	1206.6 km	12	161.139.246.129		161.139.246.129	AS16242	207.793 ms		1.5502, 103.8414 (jache)	1206.5 km	13	161.139.246.129		161.139.246.129	AS16242	205.464 ms		1.5500, 103.8440 (jache)	0.6 km	
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Landmarks with < 60msec minimum RTT to 161.139.244.5							Geolocation of 161.139.244.5	
Printing tier1 RIT data:							Locating the target 161.139.244.5 (161.139.244.5)	
Latitude	Longitude	CBG distance(km)	ID#	hostName	RTT(ms)	Type		
13.7539	100.502	5240.5	83	perfonar.uni.net.th	52.405	PerfSONAR		
13.7539	100.53	5248.7	208	perfonar-cms-2.sc.chula.ac.th	52.487	PerfSONAR		
1.4653	110.427	5259.6	132	pinget.usnma.mil	52.596	PingER		
14.0826	100.602	5809.9	265	mercury-2.lsr.netec.or.th	53.099	PerfSONAR		

Other Visual Traceroutes

- [CQ Traceoute](#), one server in St Paul, Minnesota, gives country, lat/long and distance of router from server, shows map as static image
- [DNSTools](#), one server in Frankfurt, no lat/long, provides map
- [WhatismyIPaddress](#), only takes IP addresses, tabular output identifying city, map shows end point only
- [Montis](#), has 3 servers, in US (Pacific Northwest), Europe (Ireland) and Asia/Pacific (Singapore), provides map, no lat/longs or cities
- [Visualware](#), can choose server region and a limited number of target regions, requires Java, does not support traceroutes
- [VisualRoute](#), buy application, identifies city, no lat/longs. no map
- [Free Visual](#), download free application, don't see a map
- [GTrace](#), download free application, has map
- [VTrace](#) multiple servers, gives lat/long plus error, provides map,city, country code

Of these Montis appears to be the most reasonable to compare with.

Montis Server in Singapore to UM Kuala Lumpur				
				
1	ip-10-128-244-2.ap.southwest	0 ms	0 ms	0 ms
2	ip-10-1-8-32.ap.southwest-5	0 ms	0 ms	0 ms
3	100.64.12.5	1 ms	1 ms	1 ms
4	ec2-175-81-128-232.ap.south	1 ms	1 ms	1 ms
5	205.85.235.34	0 ms	1 ms	1 ms
6	205.85.235.32	10 ms	1 ms	17 ms
7	p1275.apn.asia.net	1 ms	1 ms	1 ms
8	ae-9-3-8.scr1.hkg.cw.net	42 ms	42 ms	42 ms
9	jarling-gw.hkg.cw.net	44 ms	42 ms	42 ms
10	tel6-0-1-8.0a06.jarling.my	45 ms	42 ms	43 ms
11	tel6-0-1-8.0a06.jarling.my	45 ms	44 ms	44 ms
12	tel6-0-2-0-6.dci05.jarling.my	44 ms	45 ms	44 ms
13	161.142.24.138	42 ms	42 ms	42 ms