

Figure 24-a. The Afiliis registry infrastructure.

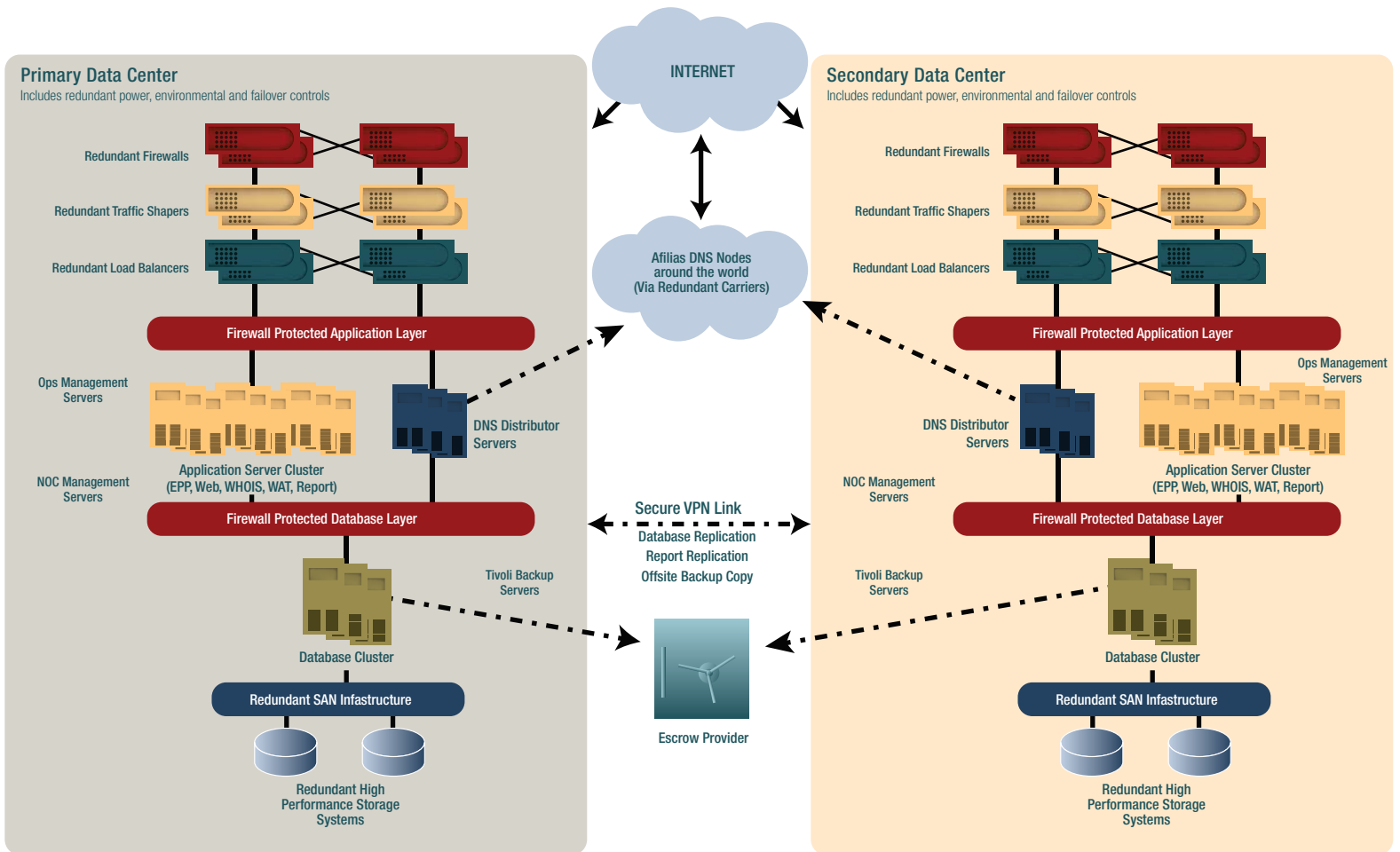


Figure 24-b. SRS/EPP performance metrics.

Parameter	Specification 10	Commitment	Example (2010 actuals for .INFO)
EPP Service Availability	≤ 864 min of downtime (≈ 98%)	Consistently meet or exceed	22min average downtime/month 99.95 % availability
EPP Session-command RTT	≤ 4000 ms, for at least 90% of the commands	Consistently meet or exceed	≤ 4000 ms, for 100% of the commands
EPP query-command RTT	≤ 2000 ms, for at least 90% of the commands	Consistently meet or exceed	≤ 2000 ms, for 100% of the commands
EPP transform-command RTT	≤ 4000 ms, for at least 90% of the commands	Consistently meet or exceed	≤ 4000 ms, for 100% of the commands
Emergency thresholds	24-hour downtime per week	Consistently meet or exceed	No equivalent of an emergency shutdown

Figure 26-a. Afiliis WHOIS service diagram.

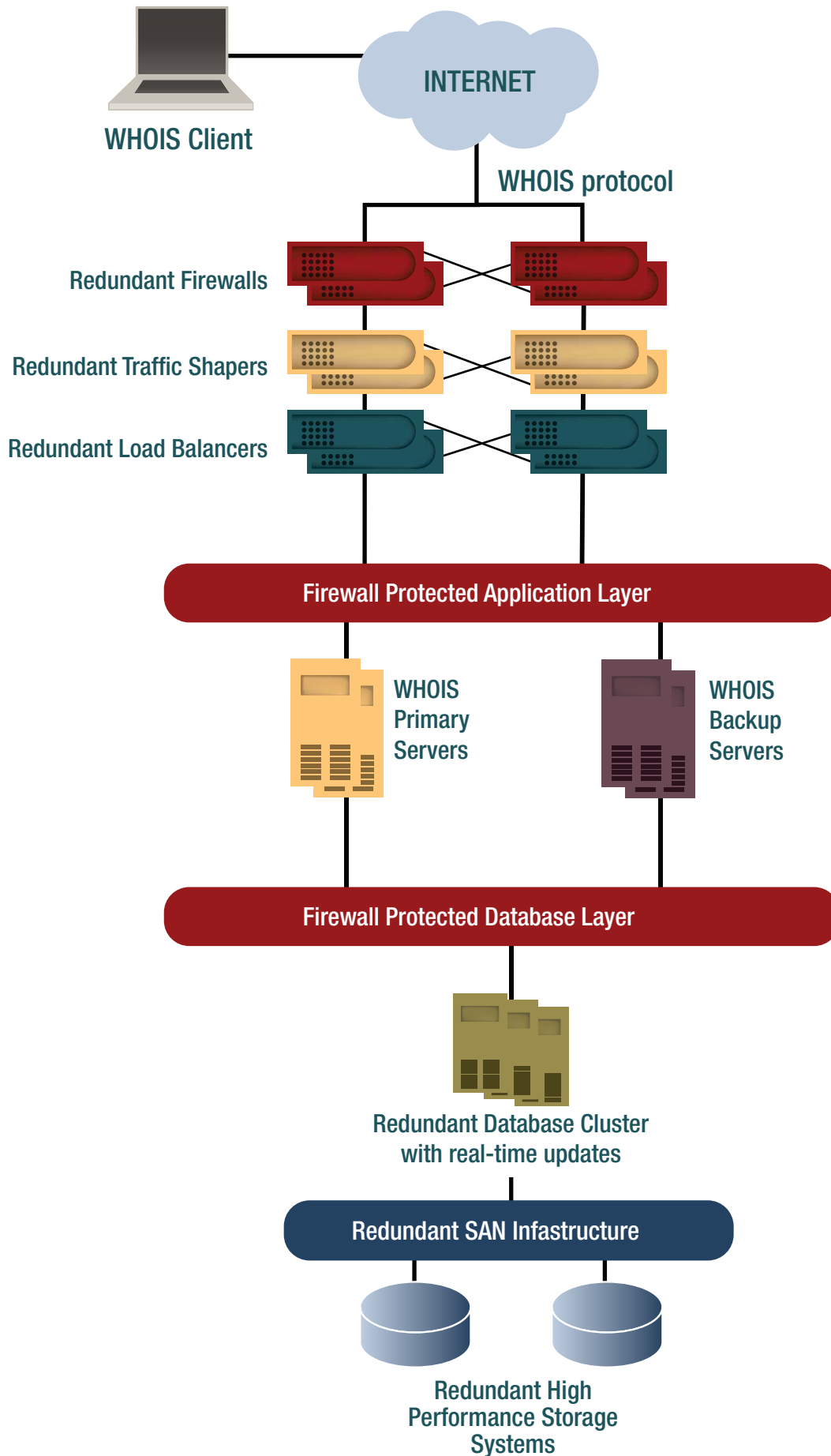


Figure 26-b. Advanced WHOIS search options for refined output.

Command	Description
ID	Search on ID field of an object. This is applied to Contact IDs and registrar IDs.
Full or '=':	Always show detailed results, even for multiple matches.
Summary or SUM	Always show summary results, even for single matches.
'%' or '...'	Used as a suffix on the input, will produce all records that start with that input string.
'_'	Used as a suffix on the input, will produce all records that start with that input string and have one and only one additional character.

Figure 26-c. Afilias WHOIS performance specifications.

Parameter	Specification 10	Commitment	Example (2010 actuals for .INFO)
RDDS Availability	≤ 864 min of downtime (≈ 98%)	Consistently meet or exceed	22min average downtime/month 99.95 % availability
RDDS Query RTT	≤ 2000 ms, for at least 95% of the queries	Consistently meet or exceed	≤ 2000 ms, for 100% of the queries
RDDS Update time	≤ 60 min, for at least 95% of the probes	Consistently meet or exceed	≤ 60 min, for 100% of the probes
Emergency thresholds	24-hour downtime per week	Consistently meet or exceed	No equivalent of an emergency shutdown

Figure 27-a. The typical lifecycle of the domain name.

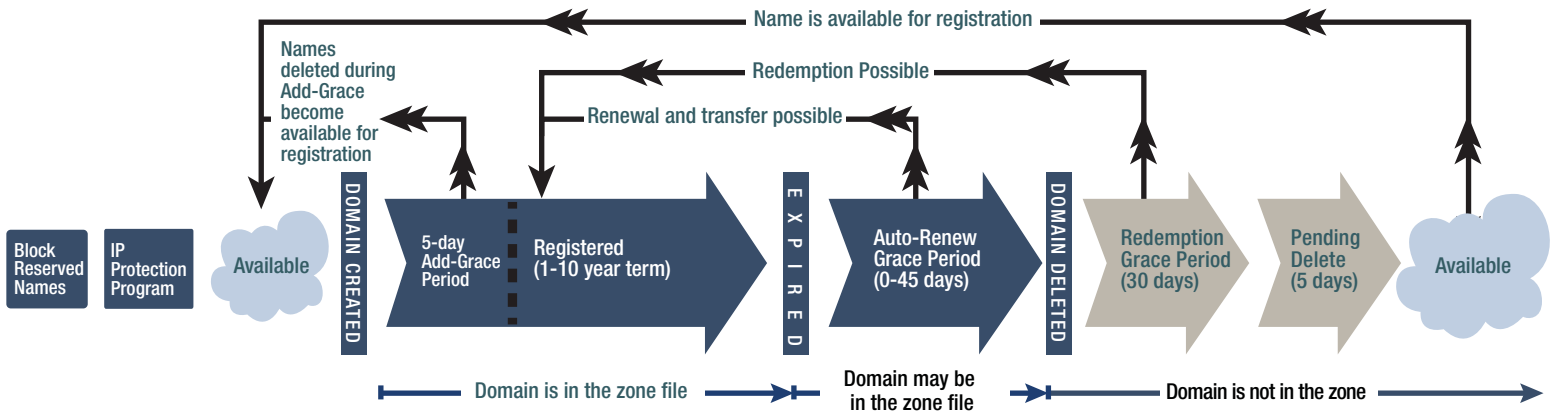


Figure 30b-a. Overview of Afilias approach to security.

CONNECTIVITY & INTERNET SERVICES SECURITY

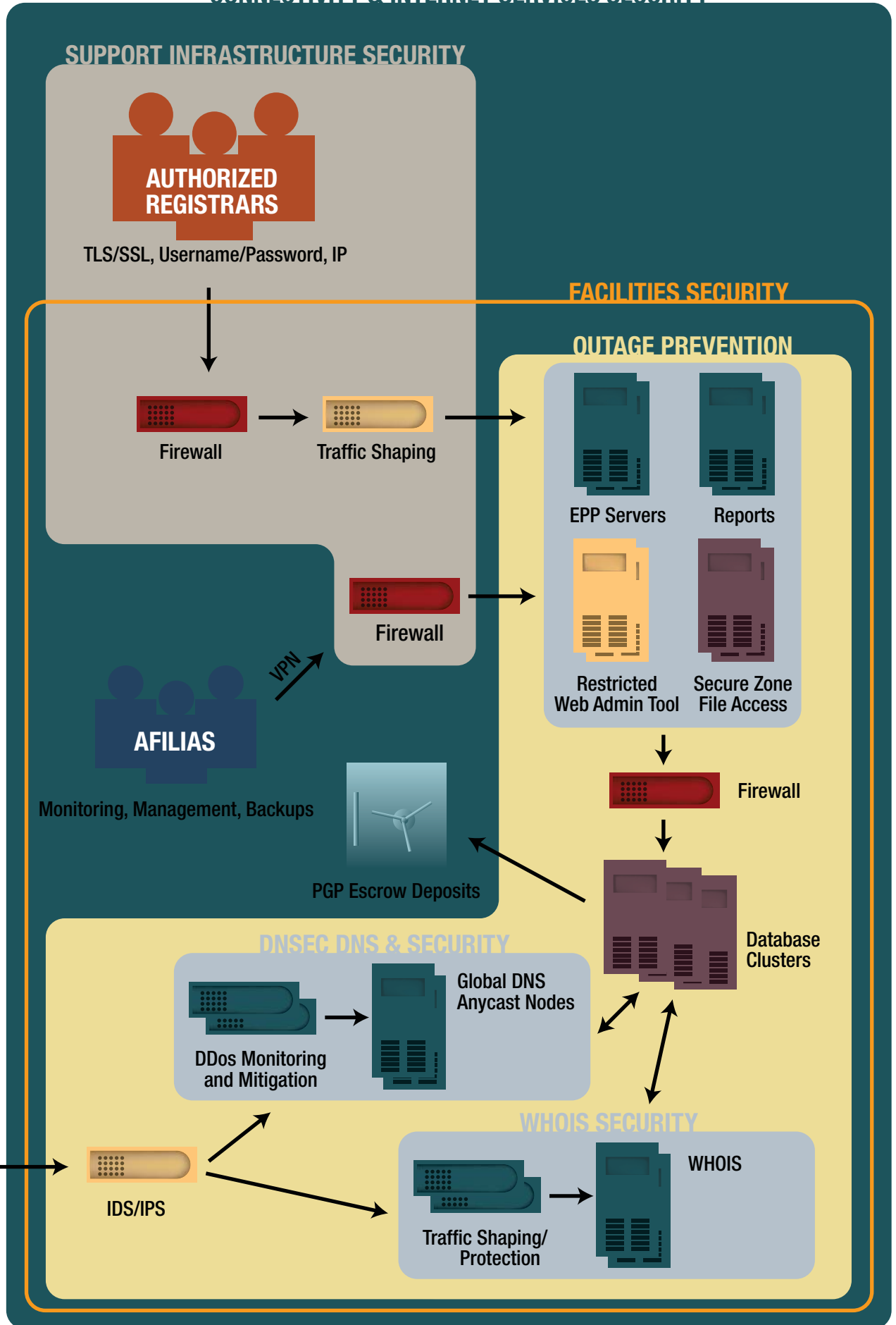


Figure 31-a. The Afilias registry infrastructure.

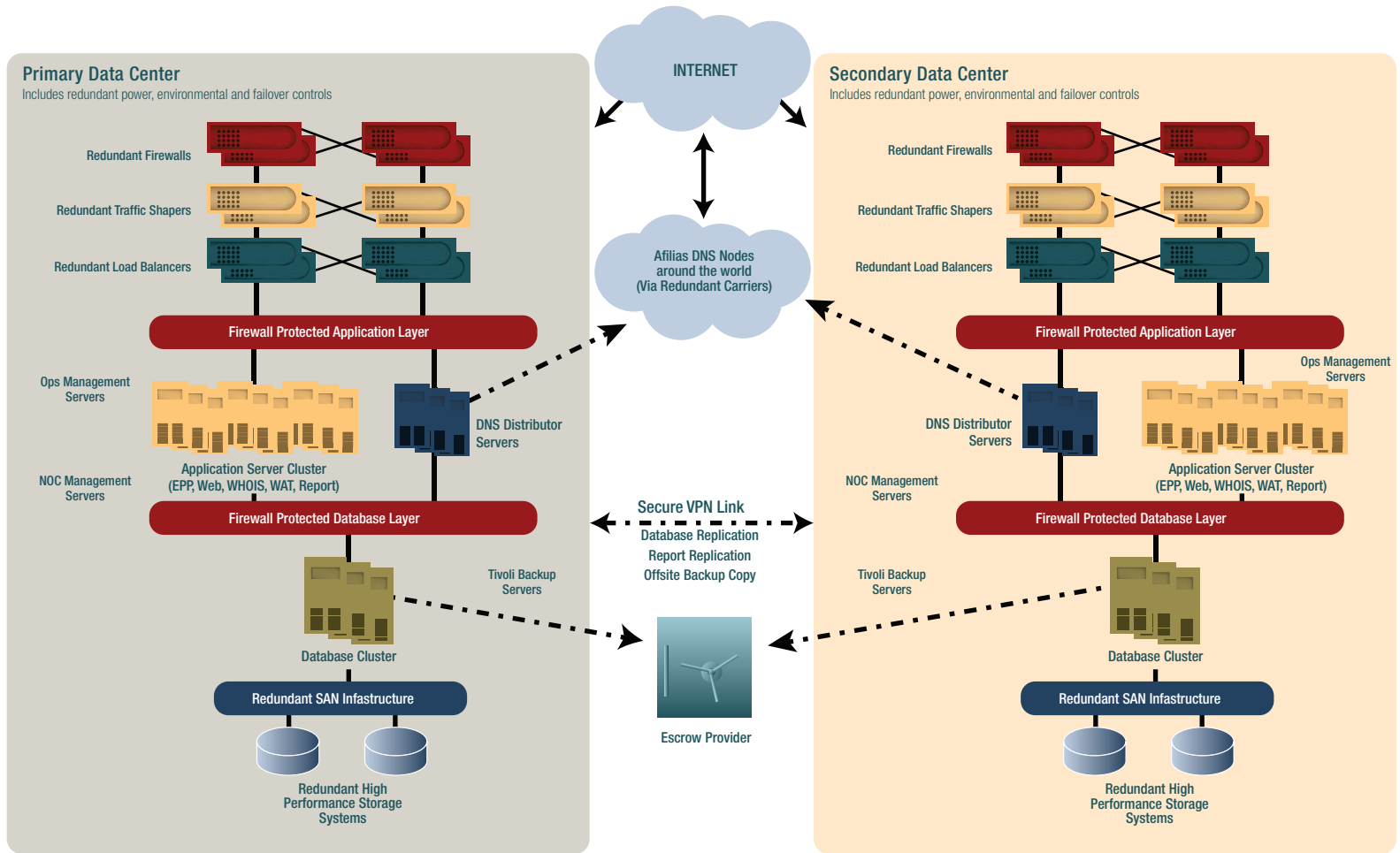


Figure 31-c. Afilias organization chart.

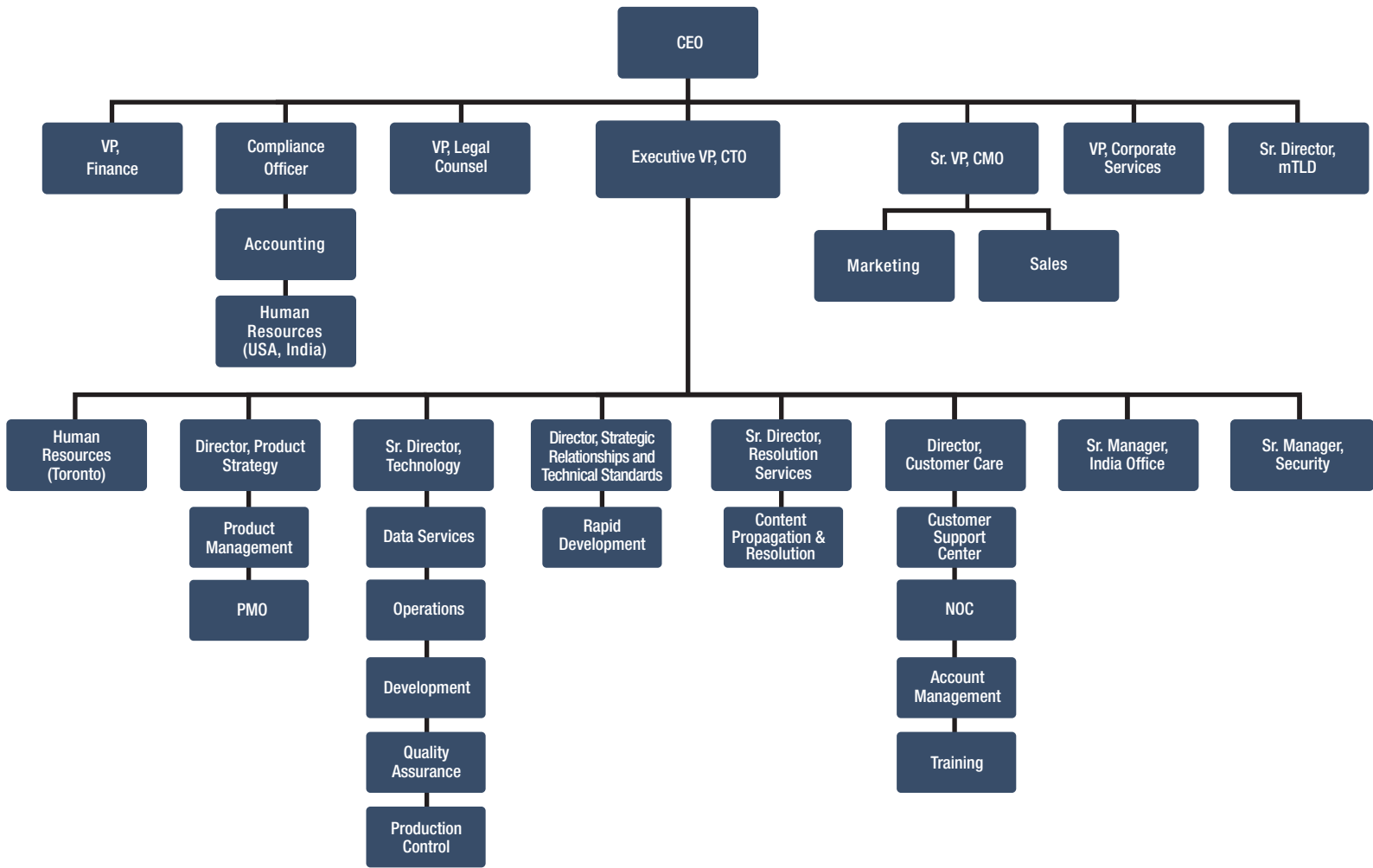


Figure 31-d. Afiliis consolidated headcount

Function	Dublin	US	Toronto	New Dehli	London	Total
Customer Service	0	6	24	4	0	34
Registry Operations	12	14	87	4	0	127
Internal Infrastructure	0	3	3	0	0	6
Sales & Marketing	6	14	0	0	1	21
Finance & Administration	12	9	4	2	0	27
Totals	30	46	118	10	1	205

Figure 32-a. The Afiliast registry infrastructure.

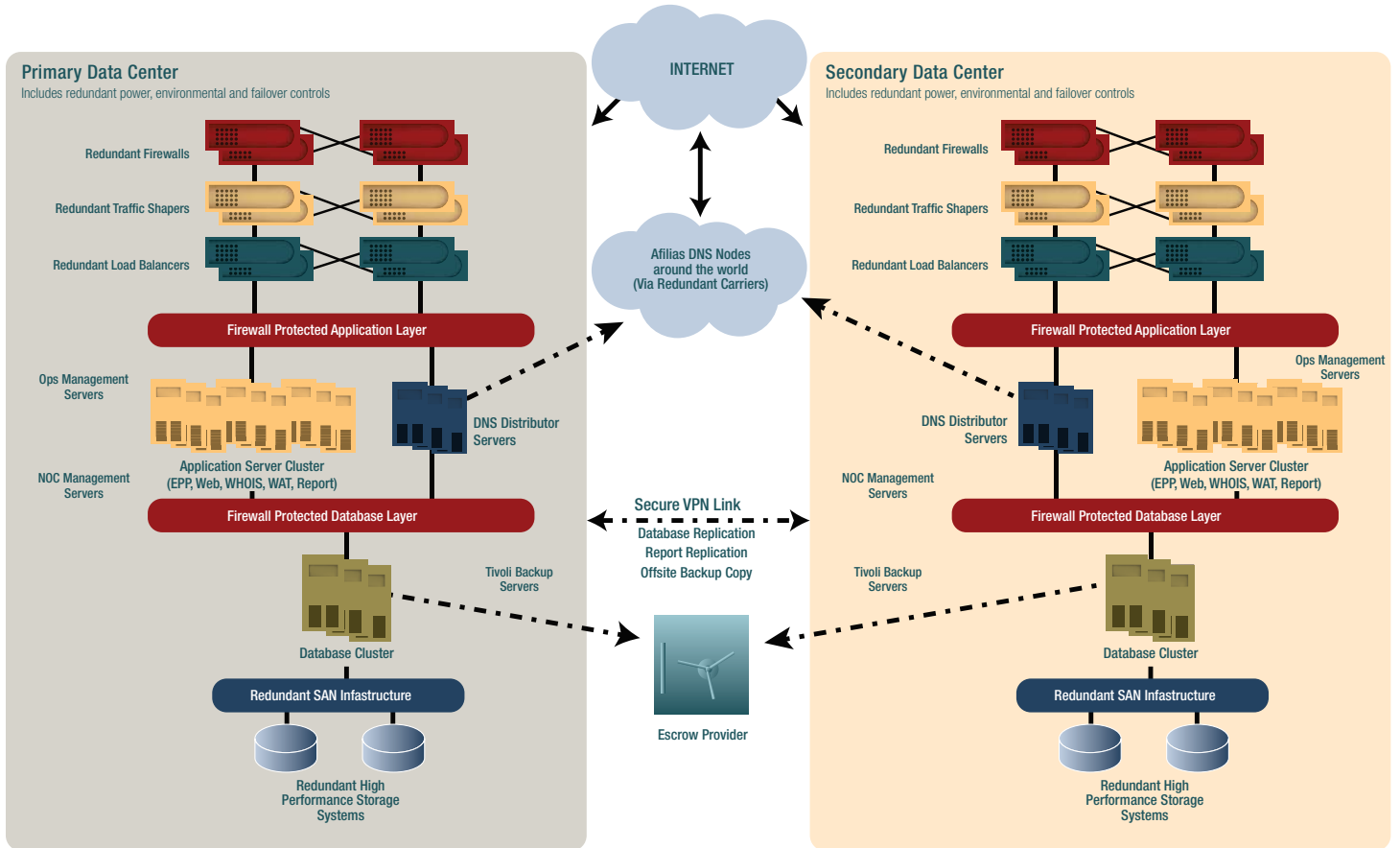


Figure 32-b Networking and computing elements of the Afilias registry.

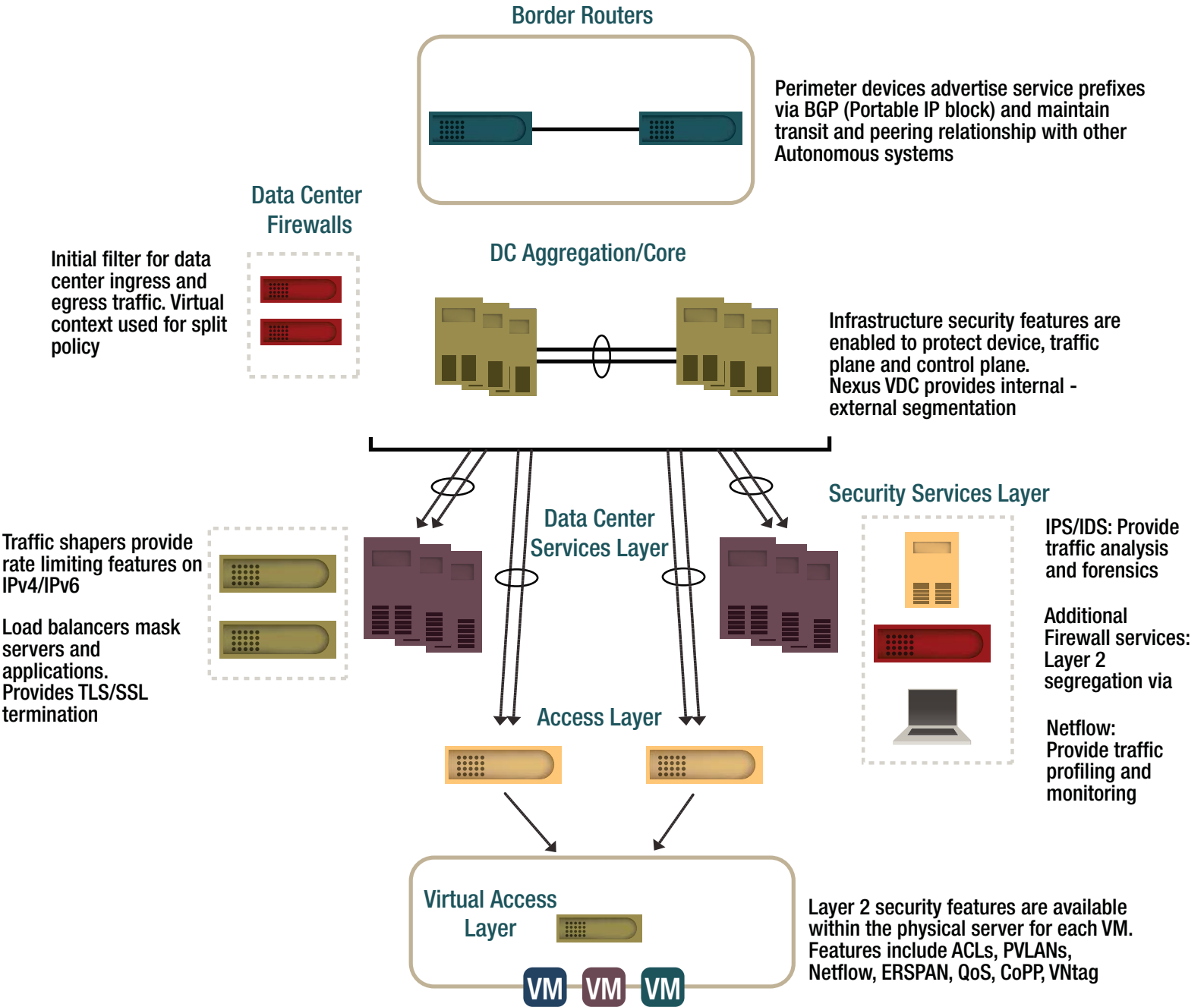


Figure 32-c. AS numbers transit and peers

ASN	Description/Use
12041	Deployed in support of the anycast distribution of authority-only TLD nameservers. This ASN is currently used to originate covering prefixes for all TLDs.
40490,12287,13714,13810,13901	Deployed to support each of the five current anycast nodes used to provide the anycast services described above, one AS per node. Each node has a unique set of transit providers as summarized below.

ASN	Transit
12041	Transit through Interoute (8928), Tiscali (3257), Tata (6453), Uunet (701), Abovenet (6461), NTT America (2914), Global Crossing (3549), Level3 (3356), Flag (15412), Reach (4637); peering at LINX, LoNAP, LIPEX, NL-IX, AMS-IX, TorIX, SIX and NOTA
40490	Transit through Tata (6453), Uunet (701)
12287	Transit through Interoute (8928), Tiscali (3257)
13714	Transit through Abovenet (6451), NTT America (2914)
13810	Transit through Flag (15412), Reach (4637)
13901	Transit through Global Crossing (3549), Level3 (3356)
393246	Transit through nLayer (4436) and Hurricane Electric (6939)

Figure 32-d. Afilias IPv4 peers.

Peer	Description	Peer
1	University of Montenegro	AS40981
2	Hurricane Electric, Inc.	AS6939
3	Level 3 Communications, LLC	AS3356
4	Abovenet Communications, Inc	AS6461
5	Global Crossing	AS3549
6	Tata Communications	AS6453
7	Flag Telecom Global Internet AS	AS15412
8	nLayer Communications, Inc.	AS4436
9	Tinet SpA	AS3257
10	NTT America, Inc.	AS2914
11	Interoute Communications Ltd	AS8928
12	Verizon Business/UUnet	AS701
13	Reach Network Border AS	AS4637
14	Eweka Internet Services B.V.	AS12989
15	ReTN.net	AS9002
16	WV FIBER	AS19151
17	Init7 Global Backbone	AS13030
18	Neotelecoms Global Backbone	AS8218
19	Net Access Corporation	AS8001
20	TERRENAP DATA CENTERS, INC.	AS23148
21	SURFnet, The Netherlands	AS1103
22	BIT BV	AS12859
23	Nexicom Inc.	AS11666
24	Afilias Canada, Corp.	AS21775
25	European Backbone of LambdaNet	AS13237
26	DE-CIX Management GmbH	AS6695
27	Open Peering Initiative, Amsterdam, The Netherlands	AS20562
28	OJSC MegaFon	AS31133
29	hotze.com GmbH	AS8596
30	RBNet	AS5568
31	JSC Company TransTeleCom	AS20485
32	Econet Carrier Services AS Numbers	AS30844
33	Probe Networks	AS29686
34	State Institute of Information Technologies	AS3267
35	Hostserver GmbH	AS29140
36	EDU-ZG-CH - Public Schools in the Canton of Zug	AS34288
37	GCap Media plc	AS39202
38	Anders Telecom CJSC	AS39792
39	i3B - Internetbreitband GmbH	AS39912
40	IPTriplePlay Ltd	AS41095
41	Portlane Network	AS42708
42	Custodian Ltd.	AS50300
43	Daisy Communications Ltd	AS5413

Peer	Description	Peer
44	ELISA Oyj / EUnet Finland Backbone AS / Saunalahti Group	AS6667
45	CJSC Comstar-Direct	AS8359
46	Maxima Managed Services (Formerly: Hotchilli/DXI)	AS8419
47	ENTANET International Ltd	AS8468
48	Obit Telecommunications, St.Petersburg, Russia	AS8492
49	Timico Ltd	AS8607
50	JSC "TRC FIORD"	AS28917
51	Toronto Internet Exchange Community	AS11670
52	Titan Networks Internet & Telecommunications	AS20640
53	HopOne Internet Corporation	AS14361
54	Catalyst2 Services Ltd	AS29636
55	JSC GLOBALNET	AS31500
56	DNS-OARC	AS112

Figure 32-e. Afiliás IPv6 peers.

Rank	Description	Peer
1	Hurricane Electric, Inc.	AS6939
2	Flag Telecom Global Internet AS	AS15412
3	Level 3 Communications, LLC	AS3356
4	NTT America, Inc.	AS2914
5	Global Crossing	AS3549
6	Tata Communications	AS6453
7	nLayer Communications, Inc.	AS4436
8	Init7 Global Backbone	AS13030
9	Tinet SpA	AS3257
10	i3B - Internetbreitband GmbH	AS39912
11	DE-CIX Management GmbH	AS6695
12	European Backbone of LambdaNet	AS13237
13	Link11 GmbH	AS34309
14	Hostserver GmbH	AS29140
15	KPN Internet Backbone	AS286
16	CJSC Comstar-Direct	AS8359
17	Probe Networks	AS29686
18	Digiweb Ltd.	AS31122
19	EDU-ZG-CH - Public Schools in the Canton of Zug	AS34288
20	JSC "TRC FIORD"	AS28917
21	Neotelecoms Global Backbone	AS8218
22	WV FIBER	AS19151
23	Portlane Network	AS42708
24	Citytelecom.ru	AS29076
25	SWITCH, Swiss Education and Research Network	AS559
26	ELISA Oyj / EUnet Finland Backbone AS / Saunalahti Group	AS6667
27	State Institute of Information Technologies	AS3267
28	Dial Telecom, a.s	AS29208
29	Toronto Internet Exchange Community	AS11670
30	A1 Telekom Austria AG	AS8447
31	Timico Ltd	AS8607
32	ReTN.net	AS9002
33	Eweka Internet Services B.V.	AS12989
34	BIT BV	AS12859
35	Nexicom Inc.	AS11666
36	SURFnet, The Netherlands	AS1103
37	Catalyst2 Services Ltd	AS29636
38	OpenCarrier eG	AS41692
39	SpaceNET AG, Munich	AS5539

Figure 32-f. Afilias registry data and transit providers.

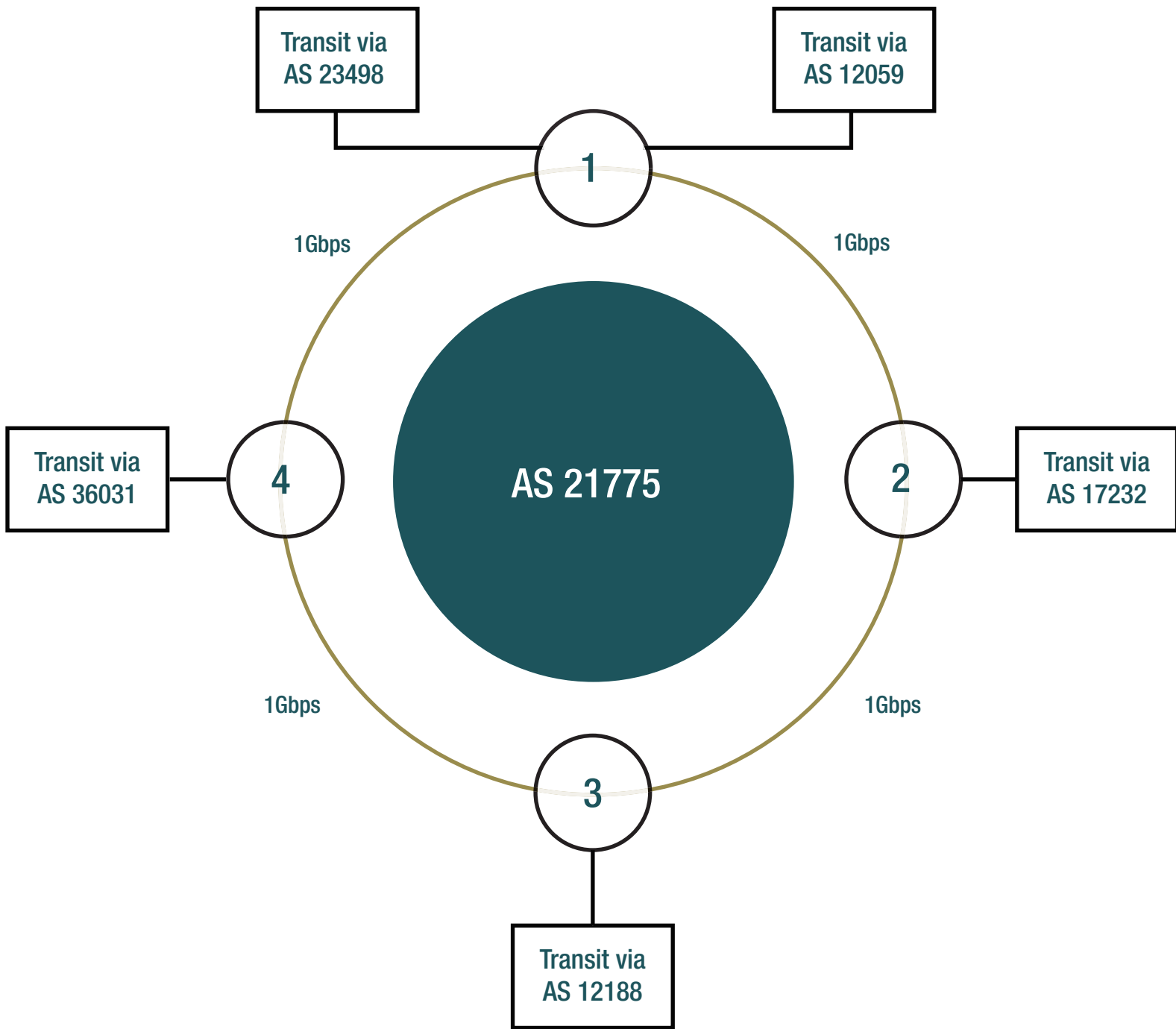


Figure 33-a. Afiliias' cascaded database replica.

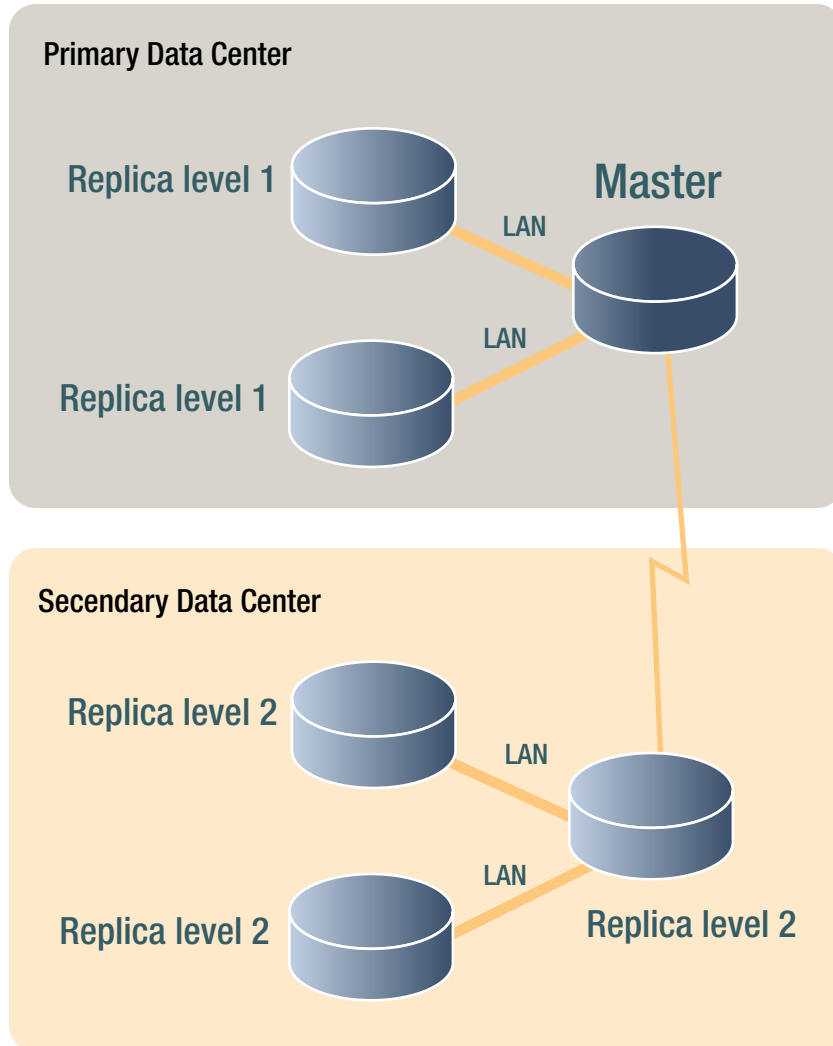
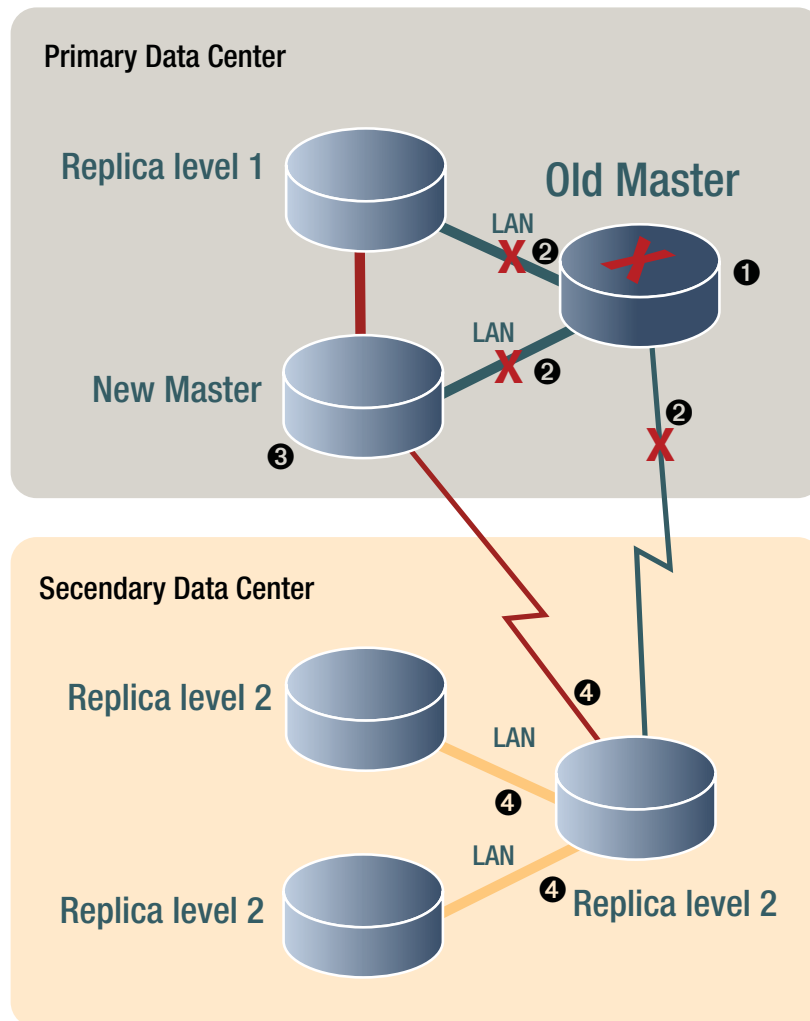


Figure 33-b. Depiction of Afilias' replication continuing in the event of failure.



- 1 An alert is raised that the master is not active or a move is planned.
- 2 A Slony command is issued to all nodes either marking the old master as "not active" or removing the mark that declares it master.
- 3 A new master is selected and a Slony command is issued marking it as master and all others as replicas.
- 4 Replication continues.

Figure 33-c. The Afilias change process workflow for database modifications.

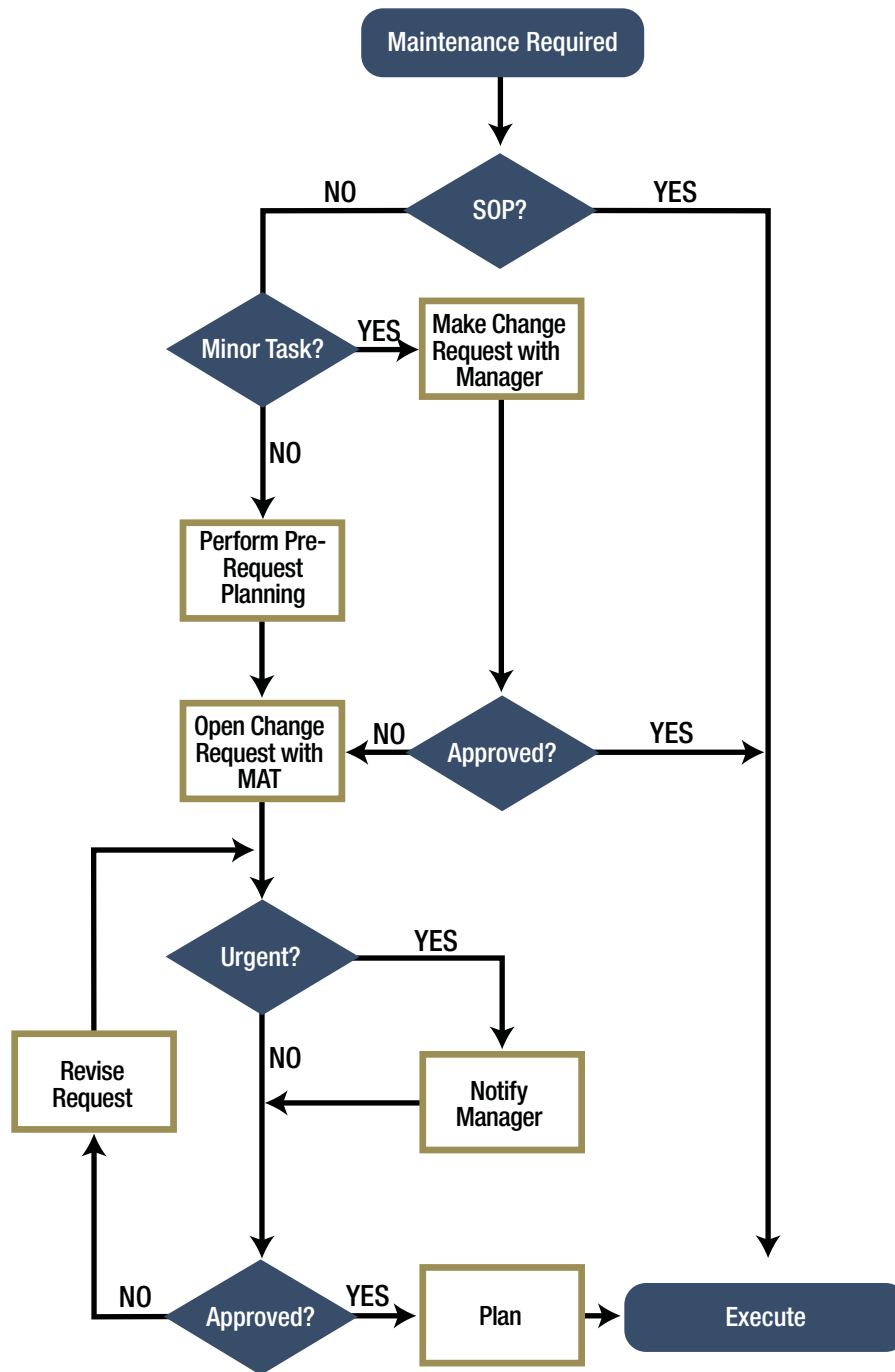


Figure 34-a. Geographic diversity of the Afilias network exists today.



AMERICAS (12)

- Atlanta
- Boston
- Chicago
- Los Angeles
- Miami**
- New York City
- Ottawa
- Palo Alto
- Seattle**
- Toronto**
- Washington, DC (2)**

EUROPE (13)

- Amsterdam (2)**
- Berlin
- Dublin
- Frankfurt
- London
- Munich
- Paris
- Turin
- Vienna
- Warsaw
- Wellington
- Zurich

ASIA (7)

- Hong Kong (2)**
- Jakarta
- Kathmandu
- Manama
- Tokyo
- Singapore

AFRICA (2)

- Cairo
- Cape Town

PACIFIC (3)

- Auckland
- Perth
- Sydney

- Primary Hub locations**
- Secondary Pods**

Figure 34-b. Diverse expansive network locations to ensure service.

Area	Afilias Hub Locations	Secondary Pod Locations
North America	Toronto, Ontario Miami, Florida Seattle, Washington Washington, D.C.	Ottawa, Ontario; Los Angeles, California; Miami, Florida; Atlanta, Georgia; Chicago, Illinois; Boston, Massachusetts; New York, New York; Seattle, Washington; and Washington, D.C.
Europe	Amsterdam, Netherlands	Vienna, Austria; Paris, France; Berlin, Frankfurt, and Munich, Germany; Dublin, Ireland; Turin, Italy; Luxembourg; Amsterdam, Netherlands; Warsaw, Poland; Zurich, Switzerland; and London, UK
Asia	Hong Kong, China	Manama, Bahrain; Hong Kong, China; Jakarta, Indonesia; Tokyo, Japan; Katmandu, Nepal; and Singapore
Pacific		Perth and Sydney, Australia; Auckland and Wellington, New Zealand
Africa		Cairo, Egypt; Cape Town, South Africa

Figure 35-a. DNS data flow diagram.

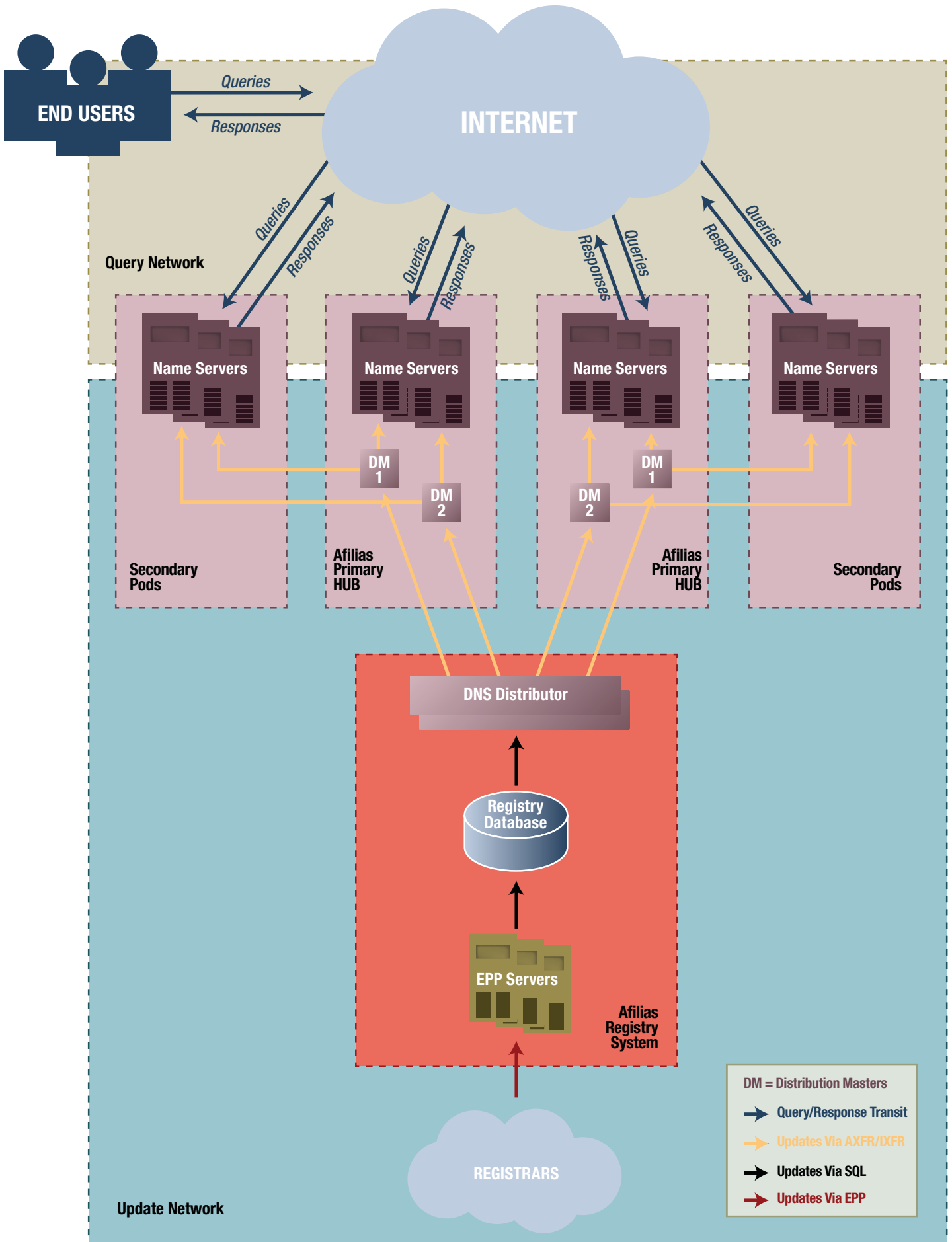


Figure 35b. Afilias Primary Hub Architecture.

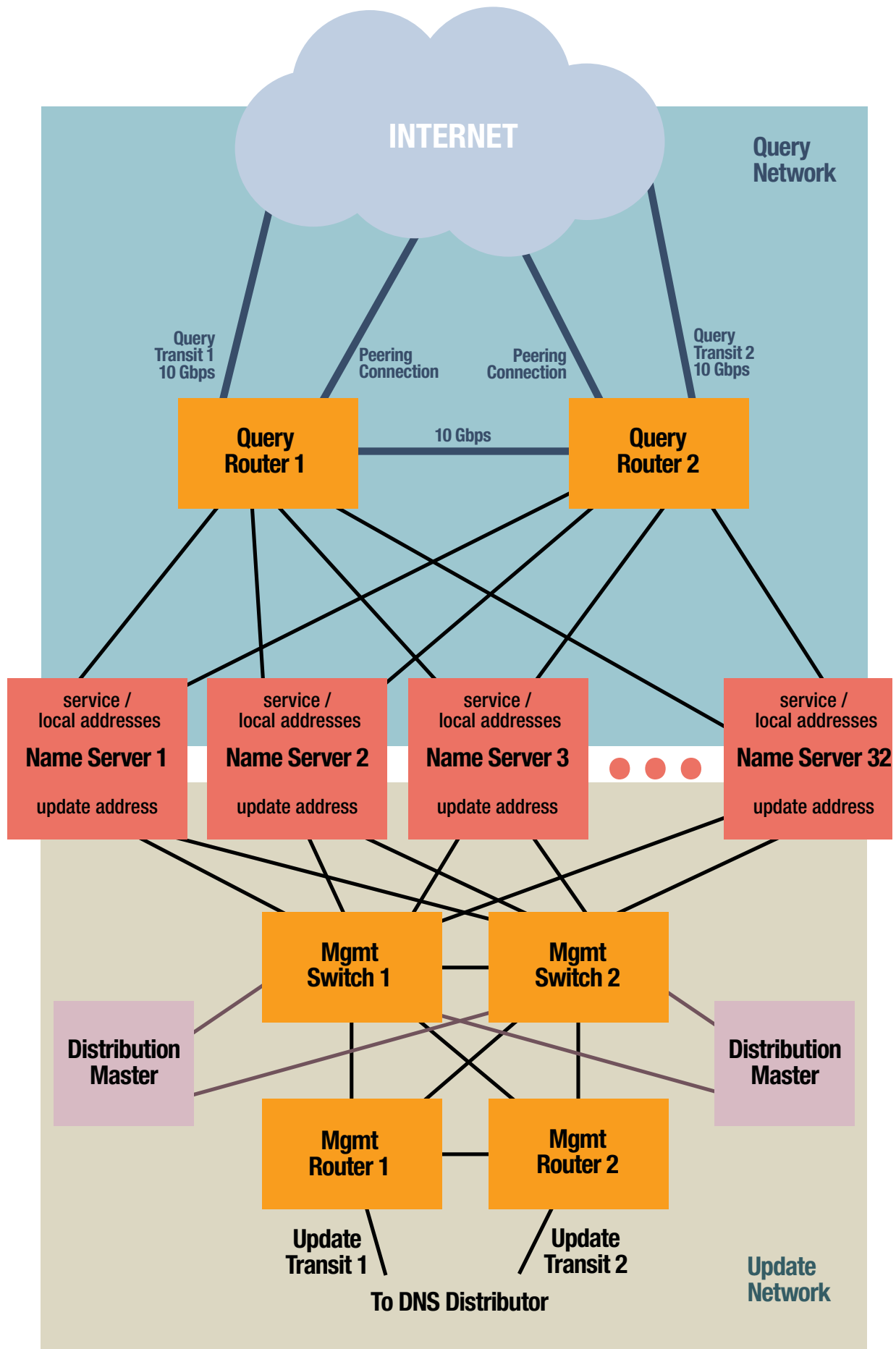
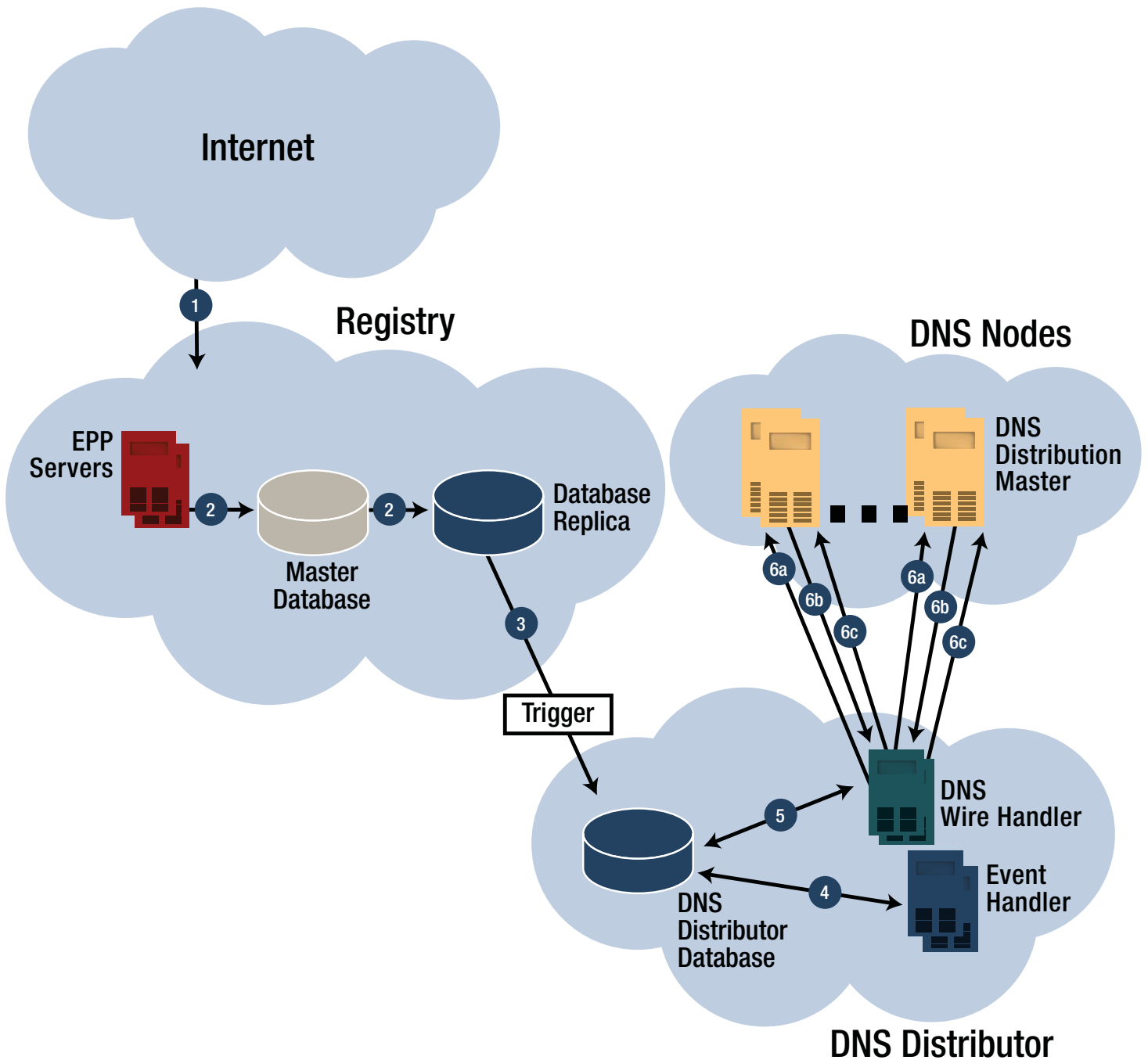


Figure 35-c. Afiliis innovation: DNS Distributor Model for near-real-time updates.



1. Registrar sends updated DNS information to Registry.
2. Master database is updated and sends data to the database replica.
3. Updates on replica fires trigger which updates the DNS Distributor database.
4. The Event Handler node connects to the database to look for updates and flags them for processing.

5. DNS Wire handler prepares records for transfer.
6. Begin transfer to DNS nodes:
 - 6a. Wire Handler sends out a DNS NOTIFY to DNS nodes regarding updates to transfer.
 - 6b. DNS nodes request data transfer.
 - 6c. Wire Handler transfers the zone (via IXFR or AXFR) to DNS nodes.

Figure 35-d. Afilias Hub nameserver cluster as of Q4 2011. This cluster is continually evolving to meet or exceed ICANN requirements.

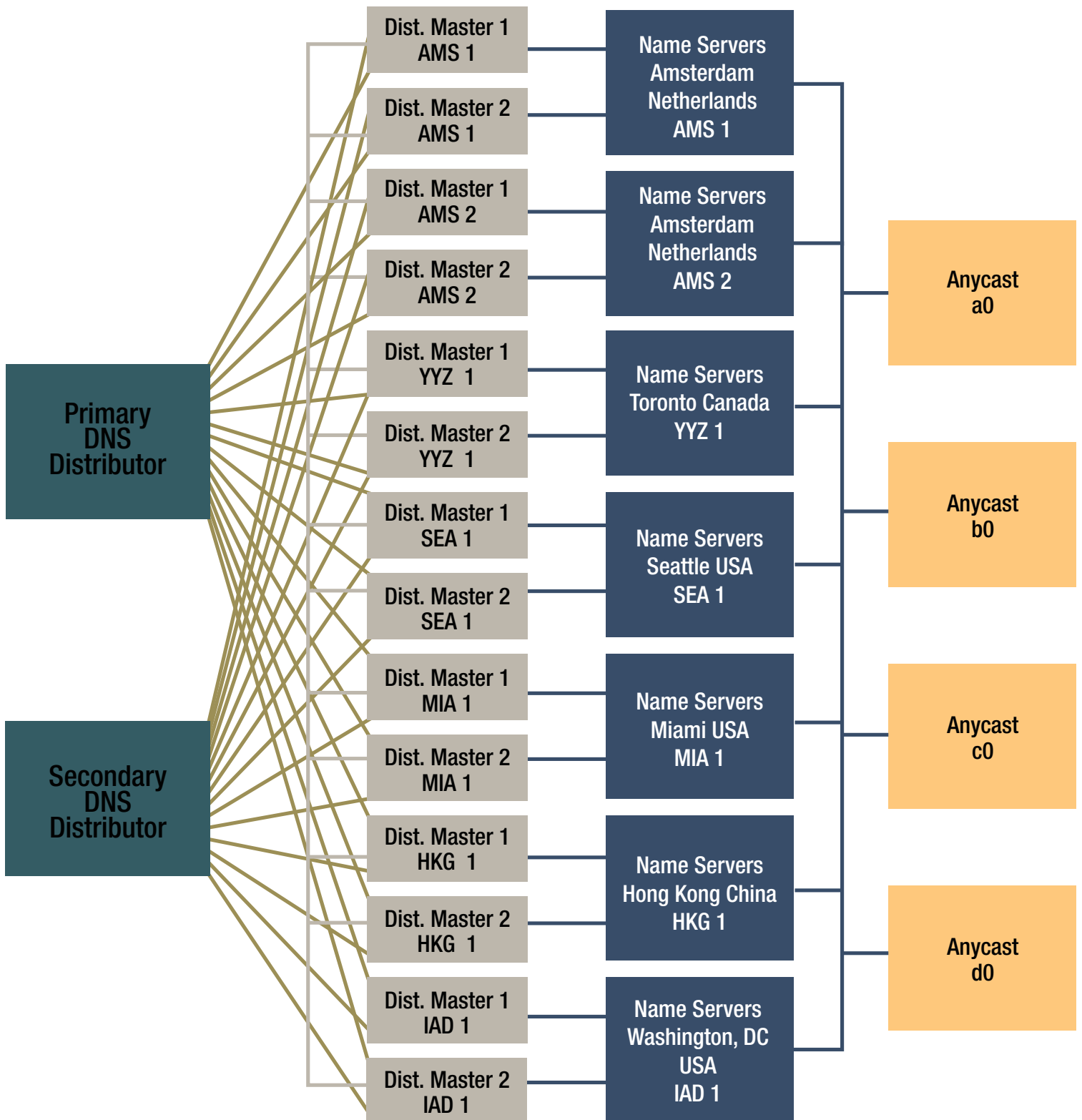


Figure 35-e. How Afilias DNS provider diversity reduces exploit vulnerability.

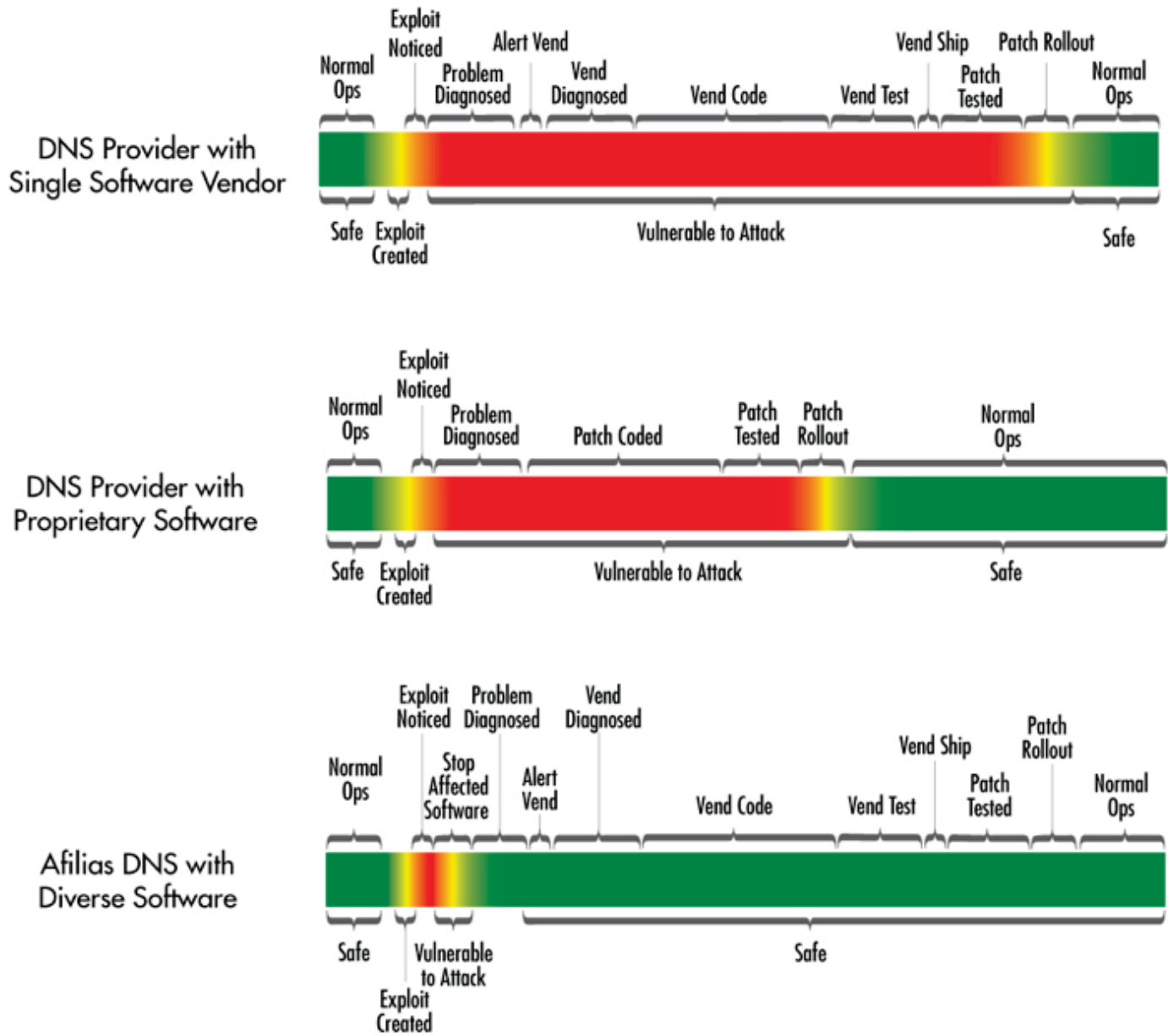


Figure 35-f. DNS Diversity throughout the Afilias architecture.

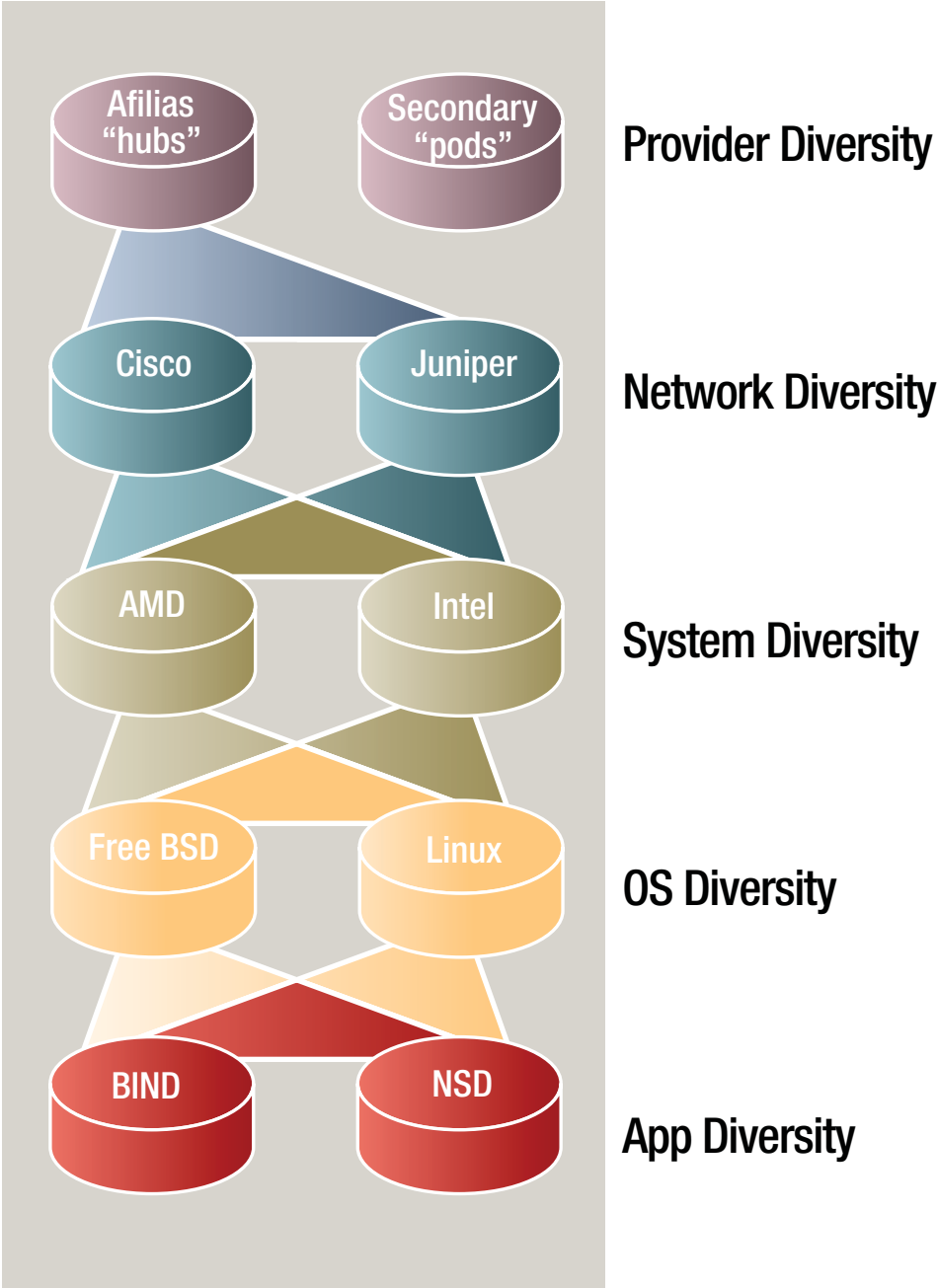


Figure 35-g. Afiliis DNS performance specifications.

Parameter	Specification 6	Commitment	Example as of 31 Oct 2011
DNS service availability	0 min downtime = 100% availability	Meets	The DNS service has not failed.
DNS name server availability	≤ 432 min of downtime (≈ 99%)	Consistently meet or exceed	No service addresses have been down.
TCP DNS resolution RTT	≤ 1500 ms, for at least 95% of the queries	Consistently meet or exceed	DNS TCP Resolution RTT: 3rd parties observe RTT values in the 40ms-50-ms range on average
UDP DNS resolution RTT	≤ 500 ms, for at least 95% of the queries	Consistently meet or exceed	DNS UDP Resolution RTT: 3rd parties observe RTT values in the 40ms range on average
DNS update time	≤ 60 min, for at least 95% of the probes	Consistently meet or exceed	DNS Update Time: DNS update time for TLD incremental zones is typically under one minute.
Emergency thresholds	4-day continuous downtime; 4-day downtime / month	Consistently meet or exceed	No equivalent of an emergency shutdown.

Figure 37-a. Afilias database backup process.

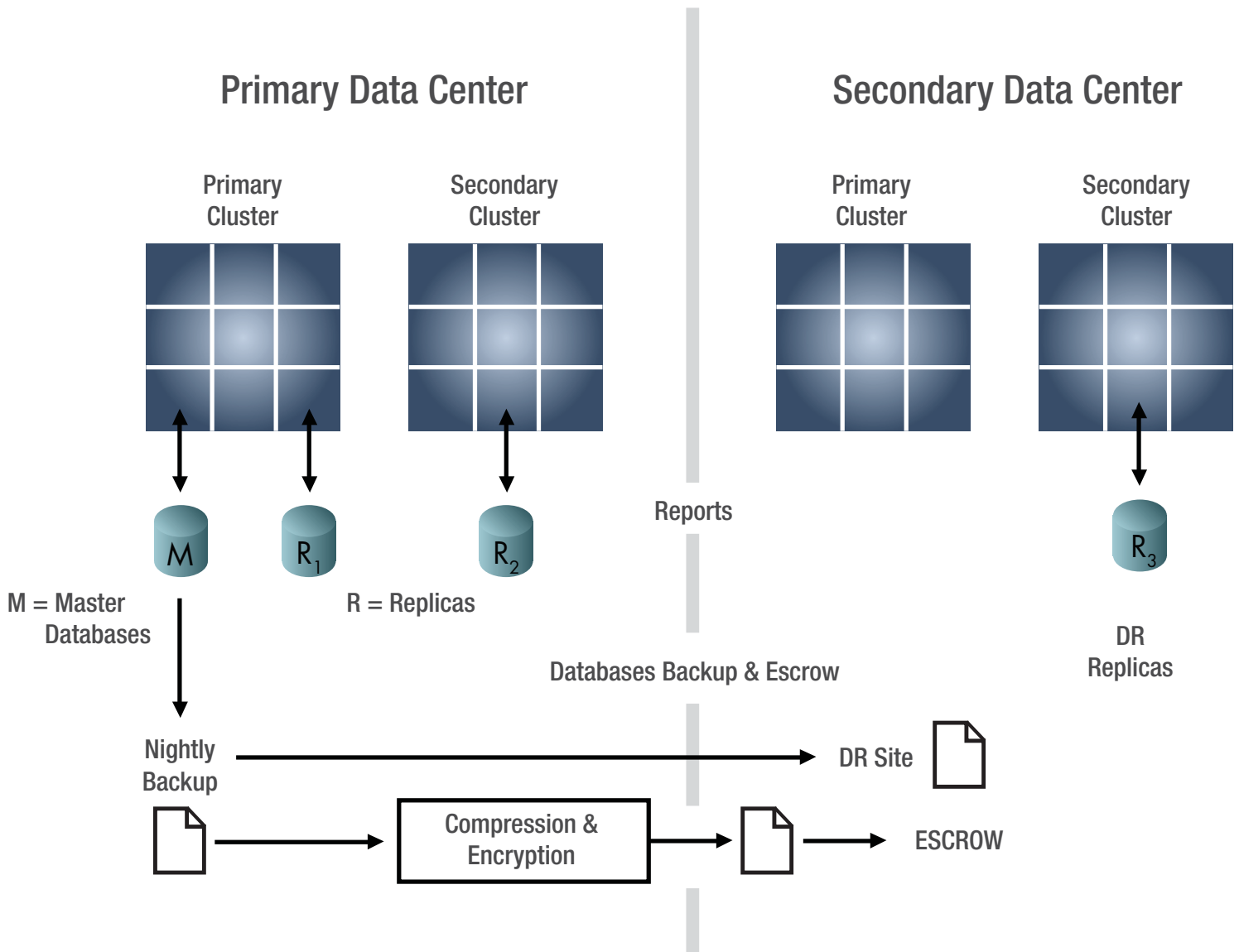
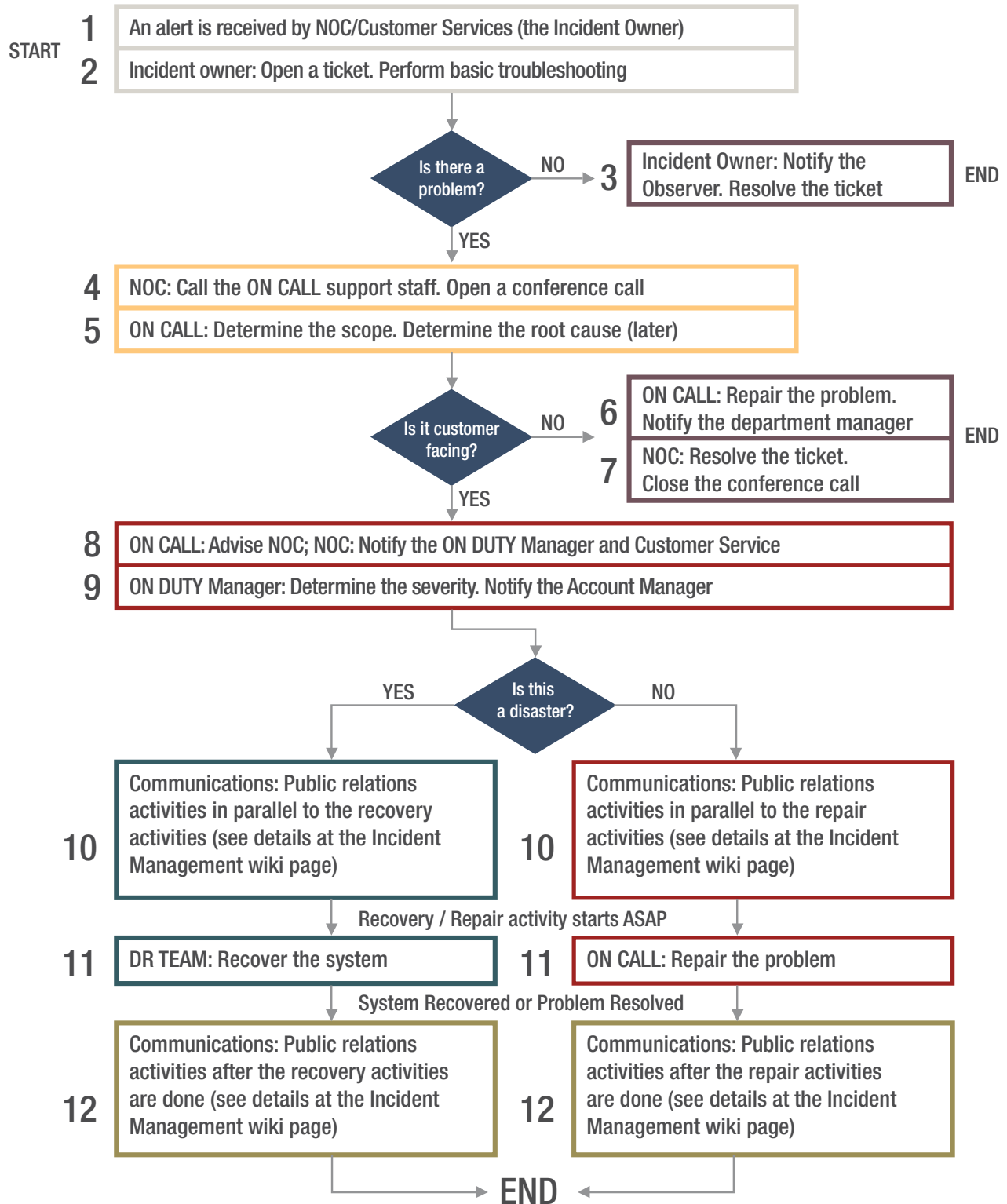


Figure 42-a. Summary of the detailed incident management at Afiliias.



Legend: Numbers' color codes

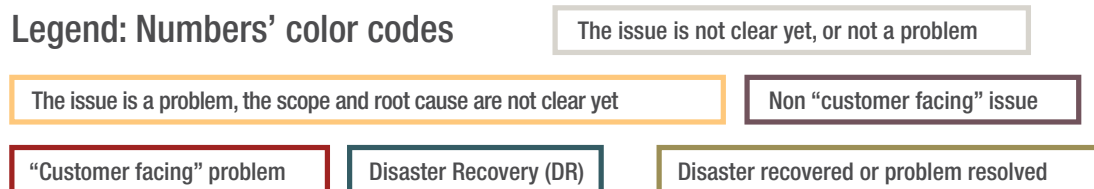


Figure 43-a. Afilias DNSSEC key management configuration.

42-a

