ZYNSTRA TECHNICAL BRIEFING NOTE

Internet Connectivity

Recommended Characteristics

To operate successfully, a Zynstra service requires one or more business grade Internet connections.

An Internet connection should be based upon one of the following technologies to operate correctly: **ADSL, ADSL+, VDSL, SDSL, DOCSIS or EuroDOCSIS cable broadband, Ethernet access or Fibre connection**.

A Zynstra service will also operate when connected to a Virtual Private Network (VPN) so long as the VPN has either a local or network wide breakout to the Internet.

The theoretical performance specification of a range of compatible connections is given in the table below. These connections advertise theoretical uplink and downlink speeds. Users should be aware that the actual speed obtained will be lowered by protocol overhead, network contention, environmental and commercial factors.

For example, the capacity of copper based access services like DSL is reduced by a 13% protocol overhead and further reduced by the distance from a central office, the gauge of the copper wire used by the carrier and the number of joints in the cable. Some providers plans have service caps that limit the total useable capacity within a month and some providers interconnect with the Internet have bottlenecks between their access network and the core Internet that cause congestion.

By way of a second example, subscribers in a multi-drop cable broadband network compete for access to a fixed capacity pool at a network head end. Therefore, the advertised bandwidth may only be available when other users on the same cable are not using their service or the capacity of the service may change dramatically from minute to minute.

Consequently, in determining the appropriate connection for a Zynstra appliance it is necessary to treat the raw capacity numbers advertised with some caution. Typically connectivity services that are business grade versions of consumer offerings need to be treated with the most care.

3G, HSDPA and 4G mobile Internet connections are also supported but only as a secondary connection in the event of the failure of a primary. These types of mobile internet connections are only suitable as a redundant link for health monitoring. They are unsuitable for performing backup, patching or any other data intensive operations.

Whatever connection is chosen, the connection provided must be free of compression, WAN optimization, protocol spoofing and other traffic engineering functions at all times. Connections must not block protocols like OpenVPN or IPsec.

It is possible to utilise bonded or load balanced connections. However, bonded or load balanced connections should be chosen when other alternatives do not perform adequately.

Zynstra does not support the deployment of its service with consumer grade Internet connections. In particular, Zynstra does not support deployment of its service within access networks that utilize Carrier Grade NAT (CGNAT) or other IP sharing technologies.

Connectivity Type	Raw download bandwidth (bits/s)	Raw Upload Bandwidth (bits/s)	Over-head for Protocol (% loss)	Assumed Contention Ratio
SDSL (2M/2M)	2,097,152	2,097,152	13.00%	1:1
ADSL+ (8M/1M)	8,192,000	1,048,576	13.00%	5:1
ADSL2+ (20M/1M)	20,480,000	1,048,576	13.00%	5:1
ADSL2+ Annex M (12M/2M)	12,582,912	2,097,152	13.00%	5:1
Bonded x2 ADSL+ (16M/2M)	16,777,216	2,097,152	13.00%	5:1
Bonded x4 ADSL+ (32M/4M)	33,554,432	4,194,304	13.00%	5:1
VDSL (40M/2M)	40,960,000	2,097,152	13.00%	5:1
VDSL (40M/10M)	40,960,000	10,240,000	13.00%	5:1
VDSL (80M/20M)	81,920,000	20,480,000	13.00%	5:1
DOCSIS 1.x (38M/9M)	39,845,888	9,437,184	13.00%	5:1
DOCSIS 2.0 (38M/27M)	39,845,888	28,311,552	13.00%	5:1
DOCSIS 3.0 (152M/108M)	138,663,690	113,246,208	13.00%	5:1
DOCSIS 3.1 (10G/1G)	9,341,553,869	934,155,387	13.00%	5:1
EuroDOCSIS 1.x (38M/9M)	39,845,888	9,437,184	13.00%	5:1
EuroDOCSIS 2.0 (50M/27M)	52,428,800	28,311,552	13.00%	5:1
EuroDOCSIS 3.0 (200M/108M)	209,715,200	113,246,208	13.00%	5:1
EuroDOCSIS 3.1 (10G/1G)	9,341,553,869	1,073,741,824	13.00%	5:1
Bonded VDSL x2 (160M/40M)	167,772,160	41,943,040	13.00%	5:1
Bonded VDSL x4 (320M/80M)	335,544,320	81,920,000	13.00%	5:1
Ethernet Access Service (4M)	4,194,304	4,194,304	13.00%	1:1
Ethernet Access Service (8M)	8,388,608	8,388,608	13.00%	1:1
Ethernet Access Service (12M)	12,288,000	12,288,000	13.00%	1:1
Ethernet Access Service (16M)	16,777,216	16,777,216	13.00%	1:1
Fibre 25M	26,214,400	26,214,400	1.30%	1:1
Fibre 50M	52,428,800	52,428,800	1.30%	1:1
Fibre 100M	104,857,600	104,857,600	1.30%	1:1
Fibre 1G	1,048,576,000	1,048,576,000	1.30%	1:1
Fibre 10G	10,597,831,803	10,597,831,803	1.30%	1:1