## ITU INTERNET REPORTS 2001: IP TELEPHONY



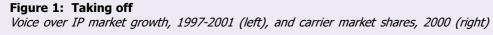
This new addition to the ITU Internet Reports series looks at the topic of IP Telephony. Internet Protocol (IP) Telephony is rapidly reaching the top of the agenda for the telecommunications industry worldwide. The key issue that has gained the attention of policy-makers, regulators, and industry alike is that the Internet, and other IP-based networks, are increasingly being used as alternatives to circuit-switched telephone networks. The many different 'flavours' of IP Telephony provide, to varying degrees, alternative means of originating, transmitting, and terminating voice and data transmissions that would otherwise be carried by the public switched telephone network (PSTN). In many countries it is now possible, using a standard telephone, to call almost any other telephone in the world by means of IP Telephony. By 2004, this could account for up to 40 per cent of all international traffic. Because these calls are mainly carried outside of the PSTN, they are also outside the regulatory and financial structures that have grown up around it.

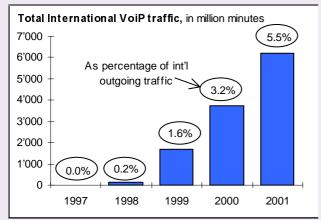
The transmition of voice over IP-based networks, with its challenges and associated opportunities, of voice and data integration, etc., constitutes a milestone in the convergence of the communications sector. Accordingly, IP Telephony has been selected as the topic of the *3rd World Telecommunication Policy Forum (WTPF)*, to be held in Geneva, 7-9 March 2001.

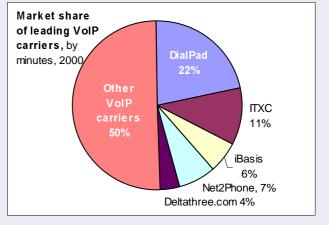
This report discusses and analyses many of the issues surrounding IP Telephony. Chapter one, 'Why IP Telephony', defines IP Telephony and looks at the different forms that IP Telephony can take. Chapter two, 'Technical Aspects of IP Telephony', suggests more specific definitions and looks at the interworking of IP-based networks with circuit-switched networks. Chapter three, 'Economic aspects of IP Telephony', looks at the reasons for the popularity of IP Telephony, which mainly stem from the fact that it offers price and cost advantages over conventional forms of telephony. Chapter three also considers the likely impact on public telecommunication



operators. Chapter four, 'Regulatory aspects of IP Telephony', discusses the different regulatory approaches to IP Telephony, and the methods used to categorize it within those regulatory structures. Chapter five, 'IP Telephony in practice', presents summaries of a series of country case studies. Finally, Chapter six, 'Conclusions', brings these different themes together and concludes that the IP Telephony industry is now approaching maturity.







Source: ITU, adapted from TeleGeography Inc. and Company annual reports.

Much of the research for this report was carried out under the 'New Initiatives' programme, launched at the ITU in 1999. The research program included the case studies and a workshop on IP Telephony in Geneva on 14-16 June 2000 (see: www.itu.int/iptel).

The ITU is committed to playing a positive role in the development of the Internet and to extending the benefits of new telecommunication technologies, such as the Internet, to all the world's inhabitants. The Minneapolis Plenipotentiary Conference (1998) passed Resolution 101, which calls upon the ITU to "fully embrace the opportunities for telecommunication development that arise from the growth of IP-based services." The ITU Internet Reports are hopefully a significant contribution to that commitment.

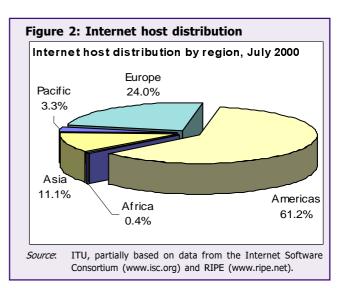


Table 1: Multimedia access

Economies rank based on the cumulative score in Teledensity, TVs, Internet hosts, and Cellular mobile density

Noverall   Rank   Economy   1999   Rank   1999		Telephone main		TV sets density		Internet host		Cellular mobile			
Norway			line density per		Ľ	per 100		density per 10'000		subscriber density per 100 inhabitants	
Norway											
1	Overall								1		
1 Norway	Rank	Economy	1999	Rank	1999	Rank	1999	Rank	1999	Rank	
Denmark	1	Norway	71.2	5	58.50	16	1'694.55	3	61.75	4	
4         Iceland         67.7         9         52.00         25         1895.69         1         61.93           5         United States         68.2         8         84.90         2         1386.99         4         31.15         2           6         Sweden         66.5         10         53.1         23         1716.40         7         58.29           7         Netherlands         60.6         12         55.3         18         1011.21         9         43.54         1           8         United Kingdom         57.5         16         64.5         9         549.93         18         46.28           9         Australia         52.1         23         70.50         7         1028.81         8         34.28         2           11         Switzerland         69.9         6         51.80         26         714.00         12         24.00         12         41.08         1           12         Japan         49.4         27         71.20         6         371.81         24         44.94         44.94         1           13         France         57.9         14         60.3         13         31	2	Finland	55.2	18	64.3	10	1'850.51	2	65.12	1	
5         United States         68.2         8         84.90         2         17386.99         4         31.15         2           6         Sweden         66.5         10         53.1         23         1716.40         7         58.29           7         Netherlands         60.6         12         55.3         18         1011.21         9         43.54         1           8         United Kingdom         57.5         16         64.5         9         54.993         18         46.28         1           9         Australia         52.1         23         70.50         7         1028.81         8         34.28         2           10         Canada         65.5         11         71.50         5         976.98         10         22.65         31           11         Switzerland         69.9         6         51.80         26         714.00         12         41.08         1           12         Japan         49.4         27         71.20         6         371.81         24         44.94         4           13         France         57.9         14         60.3         13         313.22         26 </th <th>3</th> <th>Denmark</th> <th>68.5</th> <th>7</th> <th>62.1</th> <th>12</th> <th>1'134.50</th> <th>6</th> <th>49.47</th> <th>10</th>	3	Denmark	68.5	7	62.1	12	1'134.50	6	49.47	10	
6         Sweden         66.5         10         53.1         23         1*116.40         7         58.29           7         Netherlands         60.6         12         55.3         18         1*011.21         9         43.54         1           8         United Kingdom         57.5         16         64.5         9         549.93         18         46.28         1           9         Australia         52.1         23         70.50         7         1028.81         8         34.28         2           10         Canada         65.5         11         71.50         5         976.98         10         22.65         31           11         Switzerland         69.9         6         51.80         26         714.00         12         41.08         1           12         Japan         49.4         27         71.20         6         371.81         24         44.94         1           13         France         57.9         14         60.3         13         313.13         24         44.94         4           14         Austria         48.2         31         51.6         27         583.87         16	4	Iceland	67.7	9	52.00	25	1'895.69	1	61.93	3	
7         Netherlands         60.6         12         55.3         18         1011.21         9         43.54         1           8         United Kingdom         57.5         16         64.5         9         549.93         18         46.28         1           9         Australia         52.1         23         70.50         7         1028.81         8         34.28         2           10         Canada         65.5         11         71.50         5         976.98         10         22.65         3           11         Switzerland         69.9         6         51.80         26         714.00         12         41.08         11           12         Japan         49.4         27         71.20         6         371.81         24         44.94         41.08         13           13         France         57.9         14         60.3         13         313.22         26         36.40         22           14         Austria         48.2         31         51.6         27         583.87         16         51.44           45         43.40         38         305.00         28         63.61         11 <th>5</th> <th>United States</th> <th>68.2</th> <th>8</th> <th>84.90</th> <th>2</th> <th>1'386.99</th> <th>4</th> <th>31.15</th> <th>25</th>	5	United States	68.2	8	84.90	2	1'386.99	4	31.15	25	
8 United Kingdom 57.5 16 64.5 9 1549.93 18 46.28 1 9 Australia 52.1 23 70.50 7 1028.18 8 34.28 1 10 Canada 65.5 11 71.50 5 976.98 10 22.65 3 11 Switzerland 69.9 6 51.80 26 714.00 12 41.08 1 1 1 Switzerland 69.9 6 51.80 26 714.00 12 41.08 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	6	Sweden	66.5	10	53.1	23	1'116.40	7	58.29	5	
9         Australia         52.1         23         70.50         7         1028.81         8         34.28         2.2           10         Canada         65.5         11         71.50         5         976.98         10         22.65         31           11         Switzerland         69.9         6         51.80         26         714.00         12         41.08         14           12         Japan         49.4         27         71.20         6         371.81         24         44.94         1           13         France         57.9         14         60.3         13         313.22         26         36.40         2           14         Austria         48.2         31         51.6         27         583.87         16         51.44           4         Austria         48.2         31         51.6         27         583.87         16         51.44           15         Hongkong SAR         57.6         15         43.40         38         305.00         28         63.61           16         Germany         58.8         13         58         17         361.48         25         22.85         22.2	7	Netherlands	60.6	12	55.3	18	1'011.21	9	43.54	17	
10 Canada 65.5 11 71.50 5 976.98 10 22.65 2 11 Switzerland 69.9 6 51.80 26 714.00 12 41.08 12 44.49 13 12 13 papan 49.4 27 71.20 6 371.81 24 44.94 13 13 France 57.9 14 60.3 13 313.22 26 36.40 2 14 Austria 48.2 31 51.6 27 583.87 16 51.44 15 16 Germany 58.8 13 58 17 361.48 25 28.57 17 Luxembourg 72.4 4 38.9 50 399.91 21 48.70 18 Taiwan-China 54.5 20 44.60 41 482.19 19 52.24 19 Belgium 50.2 26 52.3 24 582.19 17 31.45 2 20 New Zealand 49.0 28 51.20 28 1262.38 5 23.01 22 141y 46.2 34 48.8 30 142.60 40 52.83 22 Portugal 42.4 41 54.2 21 149.22 37 46.81 23 Ireland 47.8 32 40.7 48 298.40 28 45.67 14 24 Greece 52.8 22 47.2 34 128.14 42 31.06 25 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5	8	United Kingdom	57.5	16	64.5	9	549.93	18	46.28	13	
11	9	Australia	52.1	23	70.50	7	1'028.81	8	34.28	22	
12   Japan	10	Canada	65.5	11	71.50	5	976.98	10	22.65	35	
13   France   57.9   14   60.3   13   313.22   26   36.40   24   24   44   48.2   31   51.6   27   583.87   16   51.44   48.2   31   51.6   27   583.87   16   51.44   48.2   31   51.6   27   583.87   16   51.44   48.2   31   51.6   27   583.87   16   51.44   48.2   31   51.6   6cmany   58.8   13   58   17   361.48   25   28.57   28.57   27   27   28   28   27   28   27   28   28	11			-		26				19	
14         Austria         48.2         31         51.6         27         583.87         16         51.44           15         Hongkong SAR         57.6         15         43.40         38         305.00         28         63.61           16         Germany         58.8         13         58         17         361.48         25         28.57         2           17         Luxembourg         72.4         4         38.9         50         399.91         21         48.70         1           18         Taiwan-China         54.5         20         41.60         41         482.19         19         52.24           19         Belgium         50.2         26         52.3         24         582.19         17         31.45         2           20         New Zealand         49.0         28         51.20         28         1262.38         5         23.01         3           21         Italy         46.2         34         48.8         30         142.60         40         52.83           22         Portugal         42.4         41         54.2         21         149.22         37         46.81         1 <th>12</th> <th>Japan</th> <th>49.4</th> <th>27</th> <th>71.20</th> <th>-</th> <th>371.81</th> <th>24</th> <th>44.94</th> <th>16</th>	12	Japan	49.4	27	71.20	-	371.81	24	44.94	16	
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16         Germany         58.8         13         58         17         361.48         25         28.57         28.57           17         Luxembourg         72.4         4         38.9         50         399.91         21         48.70         1           18         Taiwan-China         54.5         20         41.60         41         482.19         19         52.24           19         Belgium         50.2         26         52.3         24         582.19         17         31.45         2           20         New Zealand         49.0         28         51.20         28         1262.38         5         23.01         3           21         Italy         46.2         34         48.8         30         142.60         40         52.83           22         Portugal         42.4         41         54.2         21         149.22         37         46.81         1           23         Ireland         47.8         32         40.7         48         298.40         28         45.67         1           24         Greece         52.8         22         47.2         34         128.14         42         31.	14		48.2				583.87	-	51.44	8	
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24         Greece         52.8         22         47.2         34         128.14         42         31.06         2           25         Spain         41.8         43         50.8         29         201.80         31         31.20         2           26         Israel         45.9         35         32.80         60         424.95         21         45.89         1           27         Singapore         48.2         30         29.00         70         679.92         15         41.88         1           28         Czech Republic         37.1         50         46.70         35         205.32         31         18.95         4           29         Korea (Rep.)         44.1         38         34.60         57         44.92         61         50.03           30         Hungary         37.1         50         44.20         36         200.76         33         16.21         4           31         Poland         26.3         68         41.30         42         81.25         46         10.21         6           32         Argentina         20.1         85         29.30         69         69.49         50										12	
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Singapore										26	
27         Singapore         48.2         30         29.00         70         679.92         15         41.88         12           28         Czech Republic         37.1         50         46.70         35         205.32         31         18.95         42           29         Korea (Rep.)         44.1         38         34.60         57         44.92         61         50.03           30         Hungary         37.1         50         44.20         36         200.76         33         16.21         4           31         Poland         26.3         68         41.30         42         81.25         46         10.21         6           32         Argentina         20.1         85         29.30         69         69.49         50         12.12         5           33         Turkey         26.5         66         31.50         65         22.02         72         11.91         2           34         Chile         20.7         81         23.60         91         47.41         59         15.05         5           35         Brazil         14.9         95         32.40         61         47.41         6		•		-				-		24	
28         Czech Republic         37.1         50         46.70         35         205.32         31         18.95         42.92         61         50.03           29         Korea (Rep.)         44.1         38         34.60         57         44.92         61         50.03           30         Hungary         37.1         50         44.20         36         200.76         33         16.21         4           31         Poland         26.3         68         41.30         42         81.25         46         10.21         6           32         Argentina         20.1         85         29.30         69         69.49         50         12.12         5           33         Turkey         26.5         66         31.50         65         22.02         72         11.91         2           34         Chile         20.7         81         23.60         91         47.74         59         15.05         5           35         Brazil         14.9         95         32.40         61         47.41         60         8.95         7           36         Mexico         11.2         101         26.10         80<		100								14	
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30         Hungary         37.1         50         44.20         36         200.76         33         16.21         43           31         Poland         26.3         68         41.30         42         81.25         46         10.21         63           32         Argentina         20.1         85         29.30         69         69.49         50         12.12         53           33         Turkey         26.5         66         31.50         65         22.02         72         11.91         63           34         Chile         20.7         81         23.60         91         47.74         59         15.05         53           35         Brazil         14.9         95         32.40         61         47.41         60         8.95         73           36         Mexico         11.2         101         26.10         80         74.19         49         7.94         7           37         Malaysia         20.3         84         17.00         111         48.23         58         13.70         5           38         South Africa         13.8         97         13.40         120         74.96		•						-		46	
31         Poland         26.3         68         41.30         42         81.25         46         10.21         6           32         Argentina         20.1         85         29.30         69         69.49         50         12.12         5           33         Turkey         26.5         66         31.50         65         22.02         72         11.91         6           34         Chile         20.7         81         23.60         91         47.74         59         15.05         5           35         Brazil         14.9         95         32.40         61         47.41         60         8.95         7           36         Mexico         11.2         101         26.10         80         74.19         49         7.94         7           37         Malaysia         20.3         84         17.00         111         48.23         58         13.70         5           38         South Africa         13.8         97         13.40         120         74.96         48         13.21         5           39         Russia         20.6         82         42.10         39         15.78		. • .								9	
32         Argentina         20.1         85         29.30         69         69.49         50         12.12         53           33         Turkey         26.5         66         31.50         65         22.02         72         11.91         63           34         Chile         20.7         81         23.60         91         47.74         59         15.05         5           35         Brazil         14.9         95         32.40         61         47.41         60         8.95         7           36         Mexico         11.2         101         26.10         80         74.19         49         7.94         7           37         Malaysia         20.3         84         17.00         111         48.23         58         13.70         5           38         South Africa         13.8         97         13.40         120         74.96         48         13.21         5           40         Venezuela         10.9         103         18.50         107         10.75         94         14.34         5           41         Thailand         8.6         115         24.00         86         11.78		0 3								49	
33         Turkey         26.5         66         31.50         65         22.02         72         11.91         6           34         Chile         20.7         81         23.60         91         47.74         59         15.05         5           35         Brazil         14.9         95         32.40         61         47.41         60         8.95         7           36         Mexico         11.2         101         26.10         80         74.19         49         7.94         7           37         Malaysia         20.3         84         17.00         111         48.23         58         13.70         5           38         South Africa         13.8         97         13.40         120         74.96         48         13.21         5           39         Russia         20.6         82         42.10         39         15.78         78         0.92         1           40         Venezuela         10.9         103         18.50         107         10.75         94         14.34         5           41         Thailand         8.6         115         24.00         86         11.78										65	
34         Chile         20.7         81         23.60         91         47.74         59         15.05         5           35         Brazil         14.9         95         32.40         61         47.41         60         8.95         7           36         Mexico         11.2         101         26.10         80         74.19         49         7.94         7           37         Malaysia         20.3         84         17.00         111         48.23         58         13.70         5           38         South Africa         13.8         97         13.40         120         74.96         48         13.21         5           39         Russia         20.6         82         42.10         39         15.78         78         0.92         1           40         Venezuela         10.9         103         18.50         107         10.75         94         14.34         5           41         Thailand         8.6         115         24.00         86         11.78         91         3.84         9           42         China         8.6         114         28.70         71         1.01		U								58	
35         Brazil         14.9         95         32.40         61         47.41         60         8.95         7           36         Mexico         11.2         101         26.10         80         74.19         49         7.94         7           37         Malaysia         20.3         84         17.00         111         48.23         58         13.70         5           38         South Africa         13.8         97         13.40         120         74.96         48         13.21         5           39         Russia         20.6         82         42.10         39         15.78         78         0.92         1           40         Venezuela         10.9         103         18.50         107         10.75         94         14.34         5           41         Thailand         8.6         115         24.00         86         11.78         91         3.84         5           42         China         8.6         114         28.70         71         1.01         133         3.42         9           43         Philippines         4.0         140         11.00         128         2.97		-						. –		60	
36         Mexico         11.2         101         26.10         80         74.19         49         7.94         7           37         Malaysia         20.3         84         17.00         111         48.23         58         13.70         5           38         South Africa         13.8         97         13.40         120         74.96         48         13.21         5           39         Russia         20.6         82         42.10         39         15.78         78         0.92         1           40         Venezuela         10.9         103         18.50         107         10.75         94         14.34         5           41         Thailand         8.6         115         24.00         86         11.78         91         3.84         5           42         China         8.6         114         28.70         71         1.01         133         3.42         9           43         Philippines         4.0         140         11.00         128         2.97         113         3.66         9           44         Indonesia         2.9         118         13.60         118         1.79 <th></th> <th></th> <th></th> <th>-</th> <th></th> <th></th> <th></th> <th></th> <th></th> <th>51</th>				-						51	
37         Malaysia         20.3         84         17.00         111         48.23         58         13.70         5           38         South Africa         13.8         97         13.40         120         74.96         48         13.21         5           39         Russia         20.6         82         42.10         39         15.78         78         0.92         1           40         Venezuela         10.9         103         18.50         107         10.75         94         14.34         5           41         Thailand         8.6         115         24.00         86         11.78         91         3.84         5           42         China         8.6         114         28.70         71         1.01         133         3.42         5           43         Philippines         4.0         140         11.00         128         2.97         113         3.66         5           44         Indonesia         2.9         118         13.60         118         1.79         121         1.06         1										70	
38         South Africa         13.8         97         13.40         120         74.96         48         13.21         5           39         Russia         20.6         82         42.10         39         15.78         78         0.92         1           40         Venezuela         10.9         103         18.50         107         10.75         94         14.34         5           41         Thailand         8.6         115         24.00         86         11.78         91         3.84         5           42         China         8.6         114         28.70         71         1.01         133         3.42         5           43         Philippines         4.0         140         11.00         128         2.97         113         3.66         5           44         Indonesia         2.9         118         13.60         118         1.79         121         1.06         1			· · · · <del>-</del>	-			_			74	
39         Russia         20.6         82         42.10         39         15.78         78         0.92         1           40         Venezuela         10.9         103         18.50         107         10.75         94         14.34         5           41         Thailand         8.6         115         24.00         86         11.78         91         3.84         5           42         China         8.6         114         28.70         71         1.01         133         3.42         5           43         Philippines         4.0         140         11.00         128         2.97         113         3.66         5           44         Indonesia         2.9         118         13.60         118         1.79         121         1.06         1		•								54	
40         Venezuela         10.9         103         18.50         107         10.75         94         14.34         5           41         Thailand         8.6         115         24.00         86         11.78         91         3.84         9           42         China         8.6         114         28.70         71         1.01         133         3.42         9           43         Philippines         4.0         140         11.00         128         2.97         113         3.66         9           44         Indonesia         2.9         118         13.60         118         1.79         121         1.06         1		17						-		55	
41         Thailand         8.6         115         24.00         86         11.78         91         3.84         91           42         China         8.6         114         28.70         71         1.01         133         3.42         93           43         Philippines         4.0         140         11.00         128         2.97         113         3.66         93           44         Indonesia         2.9         118         13.60         118         1.79         121         1.06         1				-	_					126	
42         China         8.6         114         28.70         71         1.01         133         3.42         9           43         Philippines         4.0         140         11.00         128         2.97         113         3.66         9           44         Indonesia         2.9         118         13.60         118         1.79         121         1.06         1										52	
43         Philippines         4.0         140         11.00         128         2.97         113         3.66         9           44         Indonesia         2.9         118         13.60         118         1.79         121         1.06         1							-			94	
44         Indonesia         2.9         118         13.60         118         1.79         121         1.06         1		T					_			97	
		• •		-			-	-		95	
45 India 2.7 140 7.50 140 0.42 148 0.19 1	44 45			_						123 159	

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