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BEFORE THE ARIZONA CORPORATION COMMISSION RECEIVED

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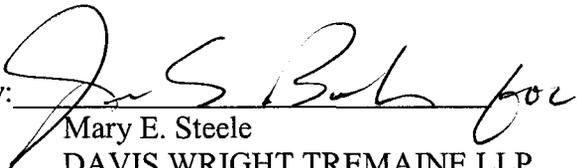
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AZ CORP COMMISSION  
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IN THE MATTER OF INVESTIGATION ) DOCKET NO. T-00000A-00-0194  
INTO U S WEST COMMUNICATIONS, )  
INC.'S COMPLIANCE WITH CERTAIN ) NOTICE OF FILING REBUTTAL  
WHOLESALE PRICING REQUIREMENTS ) TESTIMONY OF RICHARD  
FOR UNBUNDLED NETWORK ) CHANDLER AND DANIEL KELLEY  
ELEMENTS AND RESALE DISCOUNTS )

AT&T Communications of the Mountain States, Inc. and WorldCom, Inc. hereby provide  
Notice of Filing Rebuttal Testimony of Richard Chandler and Daniel Kelley.

DATED this 27<sup>th</sup> day of September, 2001.

AT&T COMMUNICATIONS OF THE  
MOUNTAIN STATES, INC. AND WORLCOM,  
INC.

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Arizona Corporation Commission  
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## CERTIFICATE OF SERVICE

I hereby certify that the original and 10 copies of the Notice of Filing Rebuttal Testimony of Richard Chandler and Daniel Kelley, regarding Docket No. T-00000A-00-0194, were hand delivered this 27th day of September, 2001, to:

Arizona Corporation Commission  
Docket Control – Utilities Division  
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A handwritten signature in cursive script, appearing to read "Arnie Ponzel", is written over a horizontal line.

**BEFORE THE ARIZONA CORPORATION COMMISSION**

**IN THE MATTER OF )**  
**INVESTIGATION INTO QWEST )**  
**CORPORATION'S COMPLIANCE ) DOCKET NO. T-00000A-00-0194**  
**WITH CERTAIN WHOLESALE )**  
**PRICING REQUIREMENTS FOR )**  
**UNBUNDLED NETWORK )**  
**ELEMENTS AND RESALE )**  
**DISCOUNTS )**

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**REBUTTAL TESTIMONY OF RICHARD CHANDLER**

**ON BEHALF OF**

**AT&T COMMUNICATIONS OF THE MOUNTAIN STATES, INC.,**

**AND WORLDCOM, INC.**

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**SEPTEMBER 27, 2001**

1 **Q. PLEASE STATE YOUR NAME, TITLE, AND BUSINESS ADDRESS.**

2 A. My name is Richard Chandler and I am Senior Vice President of HAI Consulting,  
3 Inc., 1355 South Boulder Road, Louisville, Colorado 80027.

4

5 **Q. HAVE YOU SUBMITTED TESTIMONY IN THIS PROCEEDING?**

6 A. Yes. I filed direct testimony on May 14, 2001.

7

8 **Q. PLEASE DESCRIBE YOUR BACKGROUND AND EXPERIENCE.**

9 A. My direct testimony contains this information.

10

11 **Q. WHAT IS THE PURPOSE OF YOUR TESTIMONY?**

12 A. This testimony, which is filed on behalf of AT&T Communications of the  
13 Mountain States, Inc. and WorldCom, Inc., responds to rebuttal testimony filed by  
14 Garrett Fleming, dealing with criticisms of the HAI Model's switching  
15 modulation and rebuttal testimony of Joseph Craig, Theresa Million, and Barbara  
16 Brohl concerning unbundled packet switching. I have also included in this  
17 testimony further comments on Qwest's Switching Cost Model. I adopt by this  
18 reference those portions of the Direct Testimony of Douglas Denney that have  
19 been deferred to this phase of the proceeding

20 My colleague, A. Daniel Kelley, addresses in his testimony economic issues  
21 raised by Mr. Fleming in his rebuttal that pertain to the HAI Model's switching  
22 calculations.

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**HAI MODEL SWITCHING**

**Q. MR. FLEMING CHARACTERIZES THE HAI MODEL’S SWITCHING CALCULATIONS AS A “GRAY BOX” AND COMPLAINS THAT THEY ARE COMPLEX AND DIFFICULT TO FOLLOW. IS HE CORRECT?**

A. No, and this is a particularly ironic statement, given that the investment calculations in Qwest’s Switching Cost Model (SCM) are not even viewable. When the HAI Model was under development, my clients, AT&T and MCI (now WorldCom) decided that the Model should remain as a set of Excel workbooks to allow commissioners and their staffs to view and analyze its calculations without having to learn a high-level programming language. Excel formulas are relatively easy to analyze, and Excel has a set of auditing tools that enables the user, even one with little computer experience or skill, to trace through calculations. Although whoever actually wrote Mr. Fleming’s testimony (which is, in most sections, word-for-word identical to testimony filed by other Qwest witnesses in other jurisdictions)<sup>1</sup> undoubtedly intended the term “gray box” to be clever, it is instead merely hypocritical, given the essential opacity of SCM.

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<sup>1</sup> See, e.g., “Rebuttal and Cross Answer testimony of Robert Brigham,” submitted to the Public Utilities Commission of the State of Colorado, Docket No. 99A-577T, July 20,2001, p 147.

1 **Q. MR. FLEMING FURTHER CLAIMS THAT THE HAI MODEL DOES**  
2 **NOT PRODUCE SUFFICIENT TANDEM TRUNKS. DO YOU AGREE**  
3 **WITH THIS ANALYSIS?**

4 A. No. Mr. Fleming's analysis is patently incorrect. His Exhibit 11 shows his  
5 calculations, which are based on a gross, and flawed, assumption of the total  
6 number of trunks in Qwest's Arizona network and the misapplication of certain  
7 user-adjustable input factors in the HAI Model filed in this proceeding.

8

9 **Q. HAVE YOU CORRECTED MR. FLEMING'S CALCULATIONS?**

10 A. Yes. In Exhibit RC-1, attached to this testimony, I have prepared a pair of tables,  
11 one reproducing Mr. Fleming's analysis with comments indicating his errors, and  
12 a second showing a correct form of his analysis.

13

14 **Q. WHAT IS THE EFFECT OF MR. FLEMING'S MISCALCULATIONS?**

15 A. Mr. Fleming concludes from his calculations that the HAI Model should equip  
16 more than 97,000 tandem trunks for Qwest's Arizona network. The number  
17 produced by the Model is 31,125. Had Mr. Fleming correctly calculated this  
18 value, he would have arrived at a required total tandem trunk count of 28,350.  
19 The Model is thus estimating about 3,000 more tandem trunks than Mr. Fleming's  
20 corrected analysis would require.

21

22 **Q. WHAT ARE THE MISTAKES IN MR. FLEMING'S ANALYSIS?**

1 A. Mr. Fleming begins by assuming a total count of all end-office trunks in Arizona  
2 based on an overall line-to-trunk ratio of eight to one. This assumption itself is  
3 incorrect and leads to double-counting of direct trunks. For the purposes of my  
4 study, however, I ignored this error and based my results on his original total  
5 trunk count assumption. The tandem trunks he addresses include those carrying  
6 local traffic, intraLATA toll traffic, and interLATA, or access, traffic.

7  
8 His first fundamental mistake is misinterpreting the Model's inputs for toll  
9 tandem fractions, which the Model uses to compute the number of tandem and  
10 direct trunks required to carry intraLATA toll and access traffic. He applied, for  
11 example, the intraLATA tandem fraction (whose default is 0.20, indicating that  
12 20% of intraLATA toll traffic is to be carried over tandem trunks) to the end  
13 office trunk total instead of to the intraLATA toll trunk total which is  
14 considerably small than the end office total. He makes the same mistake in  
15 calculating the number of tandem trunks required to carry tandem-routed access  
16 traffic. These mistakes combined lead to a very large overstatement of the  
17 required number of tandem trunks.

18  
19 His second mistake is including tandem-to-IXC (interexchange carrier) trunks in  
20 his tandem trunk totals. The tandem-to-IXC connections are special access  
21 facilities, and the costs for these connections, including tandem trunk ports, are  
22 recovered in Qwest's special access tariff. The Model in fact computes  
23 investment for these trunks and their associated tandem trunk ports but properly

1 includes their costs under special access, or dedicated transport. They thus should  
2 not be included in the general category of tandem trunks, as that leads to double  
3 recovery of tandem trunk port costs.

4 Exhibit RC-1 contains a detailed description of his errors and the correct  
5 calculations, according to Mr. Fleming's initial assumption of total end office  
6 trunks.

7

8 **Q. WHAT IS THE "ANALOG LINE CIRCUIT OFFSET FOR DLC LINES"**  
9 **INPUT IN THE HAI MODEL MENTIONED IN MR. FLEMING'S**  
10 **TESTIMONY?**

11 A. This is an adjustment the Model makes to end office switching investment in  
12 order to capture the switch investment reduction that results from the deployment  
13 of integrated digital loop carrier systems.

14

15 **Q. MR. FLEMING NOTES THAT THIS INPUT IS INCORRECTLY**  
16 **DESCRIBED IN THE HAI INPUTS PORTFOLIO AND FURTHER THAT**  
17 **IT SHOULD BE SET TO ZERO. IS HE RIGHT?**

18 A. Mr. Fleming is correct that the description of this input in the HAI Model Inputs  
19 Portfolio (HIP) stating that it was calculated in the FCC Inputs Order is incorrect.  
20 However, his further contention that the input value should be set to zero instead  
21 of its default of \$30 per line is not correct.

22

23 **Q. WHY SHOULD THE INPUT REMAIN AT ITS DEFAULT OF \$30?**

1 A. In the FCC's study of existing ILEC end office switch investment, 18.3% of the  
2 lines in the study were served by DLC systems. Because DLC systems are a  
3 forward-looking network technology, forward-looking cost studies usually  
4 assume much higher DLC penetrations than 18.3%. This makes it necessary to  
5 adjust the FCC's switching investments to account for the cost savings inherent in  
6 integrated DLC systems. In Arizona, for example, the HAI Model calculates a  
7 70.8% DLC penetration. If this adjustment were not made, switching investment  
8 and hence cost would be overstated on a forward-looking basis.

9

10

#### QWEST SCM

11

12 **Q. HAVE YOU BEEN ABLE TO ANALYZE THE SCM?**

13 A. Only to a limited degree. The SCM is poorly documented, and there is no  
14 detailed description of how the model works, let alone a discussion and listing of  
15 the formulas used by the model to compute investment. Furthermore, several  
16 critical input files are password-protected.

17

18 **Q. HAVE YOU OBTAINED THE PASSWORD FROM QWEST?**

19 A. Yes. Qwest partly responded to a data request by providing the password.

20

21 **Q. IS THE PASSWORD HELPFUL IN DETERMINING HOW THE SCM**  
22 **WORKS?**

1 A. No. The SCM files protected by the password are primarily input files containing  
2 specific switch investment and related inputs. There are, for example, separate  
3 input database files for 5ESS and DMS-100 switches. The databases contain  
4 tables that include what appear to be list prices of switch piece parts, tables  
5 indicating discounts, and still other tables whose purpose is unclear. Although  
6 each investment record contains an “equipment description” field, this field is  
7 often unused or it contains a cryptic description. For example, in the “PRICES”  
8 table of the ISW101a1.mdb database containing Lucent 5ESS information, there  
9 is a record for an item entitled “CM2DL16” with a description of “COMM MOD  
10 2 DATA LINK LIS” and an investment. There is no description of the function  
11 or capacity of this item or how it might be included in a given switch  
12 configuration. Many equipment descriptions just say “NONE.”

13  
14 The ISW201a1.mdb file, which contains Nortel investment data for DSM-  
15 100/200 switches, is even less useful. Most of its entries in the “PRICE” table  
16 have no equipment description whatsoever. Instead, one just finds records such as  
17 “A0286474” with a price and no explanation. There is not even any mnemonic  
18 significance, as there is with some of the 5ESS inputs (and, at that, even those are  
19 useless without cogent functional and capacity descriptions).

20  
21 **Q. WHY CAN'T THE USER JUST TRACE THROUGH THE**  
22 **CALCULATIONS AS YOU DESCRIBED FOR THE HAI SWITCHING**  
23 **MODULE?**

1 A. Because, to the best of my knowledge, the SCM's calculations are not viewable,  
2 as I noted earlier. The "core" of the SCM calculations are in an executable file  
3 called "scmcore4.exe." This file cannot be usefully viewed, as it contains object  
4 code.

5 **Q. DO YOU HAVE ANY REASON TO MODIFY YOUR ORIGINAL**  
6 **ASSESSMENT THAT THE SCM IS ESSENTIALLY AN INSCRUTABLE**  
7 **MODEL?**

8 A. No. All that has changed is that I have been able to look at a few password-  
9 protected Microsoft Access databases. These databases shed no light on the  
10 overall working of the SCM. Although they are marginally useful in assessing  
11 isolated facts about Qwest's switching investment inputs, they do nothing to  
12 explain how switches are configured by the SCM and how investments for these  
13 configuration are calculated.

14  
15 **Q. EVEN THOUGH ONE CANNOT ANALYZE THE SCM'S**  
16 **CALCULATIONS, CAN YOU MAKE ANY GENERAL STATEMENTS**  
17 **REGARDING THE LEVEL OF INVESTMENT PRODUCED BY SCM?**

18 A. No. Without seeing how switches are configured by SCM, there is no way of  
19 assessing the appropriateness of its results. Also, there is no way of knowing  
20 whether the manufacturer discount inputs represent the actual current discounts  
21 Qwest obtains from its switch vendors.

22  
23 **Q. ARE THE DEFAULT DISCOUNT INPUTS USEFUL AT ALL?**

1 A. Yes, to a limited extent. The SCM database file "Osw301a1.mdb," for example,  
2 shows in its "INPUT PARAMETERS" table that the "system discount for  
3 purchase of new switch" is identical to the "system discount for growth addition."  
4 It also shows a single (and considerably higher) "line card discount." I can only  
5 infer from these inputs that SCM assumes that investment in growth equipment  
6 costs no more than that for equivalent new system equipment.  
7 Dr. Kelley discusses the economics of Qwest's switch growth investment  
8 assumptions in his testimony.

9  
10 **UNBUNDLED PACKET SWITCHING**

11  
12 **Q. IN ADDRESSING YOUR TESTIMONY REGARDING UNBUNDLED**  
13 **PACKET SWITCHING, MR. CRAIG IMPLIES THAT YOU ARE**  
14 **UNAWARE OF THE EXISTENCE OF OTHER FORMS OF DSL THAN**  
15 **ADSL. IS THIS CORRECT?**

16 A. Of course not. I noted in my direct testimony that the term "DSL" has come to  
17 represent ADSL in the popular press as well as in service provider advertising,  
18 such as that of Qwest in print ads as well as on the Internet, and I also allude to  
19 other forms of DSL in my testimony. I have worked with clients using and  
20 contemplating other forms of xDSL, including SDSL, HDSL, and g.SHDSL, and  
21 I have taught xDSL technologies and packet switching in graduate  
22 telecommunications programs for several years.

23

1 **Q. AREN'T YOU NITPICKING WHEN YOU CRITICIZE QWEST**  
2 **WITNESSES FOR THEIR TERMINOLOGY WHEN THEY DISCUSS**  
3 **PACKET SWITCHING AND DSL SERVICE?**

4 A. Not at all. None of the Qwest witnesses in this proceeding, either in their direct or  
5 rebuttal testimony, have been able to describe in cogent technical terms the rate  
6 elements proposed by Qwest for unbundled packet switching, and they thereby  
7 obfuscate the offering. Correct terminology is obviously vital to potential  
8 competitor's understanding of what it is they will be able to obtain from Qwest  
9 and what services they in turn will be able to offer using Qwest's proposed rate  
10 elements.

11  
12 The terminology pertaining to technical aspects of ADSL and ATM is  
13 standardized by such bodies as the ATM Forum and the ADSL Forum, both of  
14 which are industry groups participating in the standard-making process. Using  
15 standard terminology removes any doubt about what is being offered and how it  
16 will work.

17  
18 **Q. PLEASE GIVE SOME EXAMPLES OF INCORRECT CONFUSING**  
19 **TERMINOLOGY USED BY QWEST'S WITNESSES.**

20 A. One notable example is Mr. Craig's use of the terms "constant bit rate," "variable  
21 bit rate," and "unspecified bit rate" in his rebuttal testimony. He was attempting  
22 to respond to statements in my direct testimony discussing various ATM service  
23 categories that involve these terms and that would be useful to CLECs. Mr. Craig

1           apparently assumes these describe a user's options with respect to the line rate  
2           available with ADSL service. These are, instead, technical terms precisely  
3           defined by the ATM Forum and are critical to the understanding of Qwest's  
4           proposed rate elements. They apply to ATM service and not ADSL, as I clearly  
5           used these terms in my direct testimony.

6  
7           Mr. Craig's discussion of virtual channels, virtual paths, and virtual circuits is  
8           similarly incorrect. The ATM Forum and ADSL Forum clearly describe and  
9           define virtual paths and virtual channels, definitions my direct testimony  
10          comports with. I should also note that Qwest also describes these terms  
11          accurately in separate technical publications that have not been introduced in this  
12          proceeding by Qwest.<sup>2</sup>

13

14   **Q.    DOES QWEST USE TECHNICALLY ACCURATE LANGUAGE IN ITS**  
15   **FILED DESCRIPTIONS OF ITS PROPOSED UPS RATE ELEMENTS?**

16   A.    No. I discussed this in my direct testimony at some length. What is interesting is  
17          that terminology used in Qwest's filed rate element descriptions does not even  
18          correspond to that used in Qwest's own technical publications pertaining to UPS.

19

20          As an example, I noted in my direct testimony that the term "Committed Bit  
21          Rate" is imprecise and does not instruct a potential purchase of the UPS rate  
22          elements about what is being offered. Qwest's Technical Publication 77408,

1           which discusses Unbundled Packet Switching, does not use this term and instead  
2           uses the proper ATM term of "Unspecified Bit Rate." It goes on to describe other  
3           details, including service quality parameters, of this ATM service class, again  
4           using precise terms that allow the reader to understand unambiguously the nature  
5           of the service.

6

7   **Q.    GIVEN THAT THERE IS A TECHNICALLY COMPETENT**  
8   **DESCRIPTION OF UPS PRODUCED BY QWEST, DOES IT ADDRESS**  
9   **YOUR CONCERN THAT QWEST HAS NOT PROVIDED RATE**  
10 **ELEMENTS THAT ARE USEFUL TO A CLEC?**

11 A.    No. The Qwest technical publication describes in technically precise language a  
12       service that is not especially interesting to a potential competitor, for all the  
13       reasons I cited in my direct testimony. The document just confirms that the  
14       proposed rate elements describe nothing more than the components of services  
15       available today to residential end users. They do not include the service classes or  
16       quality of service guarantees that would allow a CLEC to offer, for example,  
17       packet voice service over DSL, which would enable the offering of competitive  
18       voice service. These rate elements would support only the lowest level of DSL  
19       and ATM service, useful primarily for email access and casual internet usage.  
20       They are not suitable, as I have previously noted, for the provision of more  
21       advanced services that CLECs could offer business and those residential users  
22       requiring them.

---

<sup>2</sup> See, e.g., Asymmetrical Digital Subscriber Line Forum, Technical Report TR-002, ATM over ADSL Recommendations, March, 1997, p 8/17, and Qwest Communications International Inc. Technical

1

2 **Q. EVEN THOUGH QWEST ONLY PROPOSES THE MOST BASIC LEVEL**  
3 **OF SERVICES IN ITS UPS RATE ELEMENTS, CAN QWEST ITSELF**  
4 **OFFER THE HIGHER-LEVEL SERVICES YOU DISCUSS?**

5 A. Of course it can. It is free to offer whatever ATM service classes it desires to its  
6 customers, all the while denying these to its competitors.

7

8 **Q. MS. BROHL COMPLAINS IN HER REBUTTAL TESTIMONY THAT**  
9 **YOU DO NOT ACKNOWLEDGE THE FCC'S REQUIREMENTS FOR**  
10 **THE OFFERING OF UNBUNDLED PACKET SWITCHING BY ILECS.**  
11 **IS HER CRITICISM VALID?**

12 A. It is not valid. I am a technical, not a policy, witness. I believe, however, that this  
13 Commission is not limited by the FCC's requirements in this matter and in fact  
14 can go beyond what the FCC has said to foster competition in Arizona. I have  
15 described for the Commission the inadequacy of the technical aspects of Qwest's  
16 proposed UPS rate elements and the failure of Qwest's witnesses to give a cogent  
17 explanation of what is being offered.

18

19 **Q. IN YOUR DIRECT TESTIMONY, YOU EXPLAINED WHY QWEST'S**  
20 **UPS COST STUDY WAS NOT FORWARD-LOOKING. HAS QWEST**  
21 **CORRECTED THIS IN THEIR CURRENT UPS COST STUDY?**

22 A. No. The new cost study again assumes what appears to be a Lucent "overlay"  
23 system that works with a copper-based digital loop carrier (DLC) system. As I

1 explained in my earlier testimony, DLC on copper feeder facilities is not forward-  
2 looking. This new study does not correct the earlier deficiency.

3

4 **Q. BUT MS. MILLION POINTS OUT IN HER REBUTTAL TESTIMONY**  
5 **THAT THE HAI MODEL ITSELF USES COPPER FEEDER FACILITIES.**  
6 **IS SHE CORRECT?**

7 A. She is correct in stating that the HAI Model uses copper feeder. It does not,  
8 however, equip digital loop carrier systems using copper feeder. It instead always  
9 uses fiber feeder with DLC serving main clusters.

10

11 **Q. MR. CRAIG STATES THAT QWEST USES AN “OVERLAY” TO**  
12 **PROVIDE ADSL ON EXISTING DLC SYSTEMS. IS THIS**  
13 **APPROPRIATE?**

14 A. Qwest has chosen to provide ADSL to some of their customers now served on  
15 copper-based DLC systems with the “overlay” approach. That may be an entirely  
16 appropriate way to extend newer services to subscribers now served by an  
17 obsolete loop carrier system. It is not an appropriate basis for a forward-looking  
18 cost study, however. There is certainly nothing wrong with Qwest’s attempting to  
19 circumvent the limitations of antiquated plant, but it is entirely wrong to use such  
20 an architecture to develop forward-looking costs. The correct forward-looking  
21 technology is fiber-based DLC, and Qwest should have used this in their cost  
22 study.

1 **Q. MS. BROHL STATES THAT QWEST'S DSL SERVICE IS "ALWAYS**  
2 **ON." DO YOU AGREE?**

3 A. Qwest's current ADSL retail services are "always on." I do not and did not, in  
4 my direct testimony, dispute that.<sup>3</sup> My concern was, and is, that Qwest's  
5 witnesses have failed to describe their proposed rate elements using technically  
6 competent language so that potential competitors can understand precisely what  
7 would be available to them using these rate elements.

8 **SUMMARY**

9  
10 **Q. PLEASE SUMMARIZE YOUR TESTIMONY**

11  
12 A. Mr. Fleming's criticisms of the HAI Model's switching calculations are  
13 unfounded. He has, for example, incorrectly assumed that the Model produces  
14 too few tandem trunks and hence investment by using a demonstrably flawed  
15 analysis. He also inappropriately and ironically complains that he cannot  
16 decipher the Model's switching investment calculations when in fact they are  
17 entirely viewable and auditable while the SCM's corresponding calculations  
18 cannot even be seen.  
19  
20 Regarding the SCM, even the availability of the passwords that are required to  
21 view some of its constituent database files does not allow one to analyze the  
22 model's calculations, and it is not possible to determine the validity of its results.

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<sup>3</sup> Qwest in the past offered (but no longer offers) a service known as Qwest DSL Select<sup>SM</sup> that allows users only limited connection intervals. Mr. Craig attempted to describe that service in his rebuttal, but the service had already been "grandfathered" at the time his rebuttal was submitted. See Qwest Tech Pub 77392, Issue H, May, 2001, p 2-8.

1 Finally, Qwest has failed entirely to produce technically valid testimony  
2 explaining its proposed UPS rate elements, even though Qwest has elsewhere  
3 published documentation that describes in technically accurate terms the nature of  
4 its proposed service. The proposed level of service is no greater than that of  
5 Qwest's current residential retail ADSL service and is insufficient to allow  
6 potential competitors the ability to offer sophisticated ATM-based services to  
7 their end users.

8 **Q. DOES THIS CONCLUDE YOUR TESTIMONY?**

9 **A. Yes.**

10

Ref	Description	Value	Source	Comments
A	Number of working lines in AZ	2,959,791	HAI	
B	Line to end office trunk ratio	8	Typical configurations in Qwest	
C	Estimated end office trunks	369,974	A / B	
D	Interoffice Local Actual Minutes	33,274,339,645	HAI DZ Report, Inputs tab, cell C103	
E	Toll Actual Minutes	15,272,928,000	HAI DZ Report, Inputs tab, cells C104+C105	
F	Total Trunk Minutes	48,547,267,645	D + E	
G	Local % of end ofc trunks	0.69	D / F	
H	Local end ofc trunks	253,580	C * G	Erroneous application of tandem factor; Fleming applies to total end office trunks; should be applied to total intraLATA trunks Incorrect product
I	Tandem fraction of intraLATA	0.20	HAI DZ Report, Inputs tab, cells C32	
J	Tandem trks for IntraLATA	50,716	H * I	
K	Toll end ofc trunks	116,393	C - H	
L	Tandem fraction of interLATA	0.20	HAI DZ Report, Inputs tab, cells C33	Erroneous application of tandem factor; Fleming applies to total toll trunks; should be applied to total interLATA trunks Incorrect product
M	End ofc to tdm trks for InterLATA	23,279	K * L	
N	Tandem to IXC trunks	23,279	Assumed same as M	Tandem to IXC trunks are special access facilities; trunks and trunk port costs recovered in access tariff. This total should not be included here, as it leads to double recovery of cost.
O	Total tandem trunks	97,273	J + M + N	

Corrected analysis using basic Fleming assumptions

A	eo trunks (Fleming)	369,974	Fleming assumption
B	toll fraction of total minutes	0.202	(3006928 + 12266000)/75735999; see usage table below
C	total toll trunks	116,393	A x B
D	intraLATA fraction of toll	0.197	3006928/15272928
E	intraLATA trunks	22,915	C x D
F	tandem fraction of intraLATA	0.20	HM input assumption
G	intraLATA tandem trunks	4,583	E x F
H	interLATA fraction of toll	0.803	1 - D
I	interLATA trunks	93,478	C x H
J	tandem fraction of interLATA	0.20	HM input assumption
K	tandem interLATA trunks	18,696	I x J
L	total local trunks	253,580	A - C
M	tandem fraction of local traffic	0.02	HM input assumption
N	tandem local trunks	5,072	L x M
	<b>total tandem trunks - Fleming assumptions</b>	<b>28,350</b>	<b>G + K + N</b>
	total tandem toll trunks from HM	25,473	
	total local tandem trunks from HM	5,652	
	<b>total tandem trunks from HM</b>	<b>31,125</b>	

ARMIS usage data from HM

local DEMs, thousands	60,463,071	fraction of total	0.798
intraLATA DEMs, thousands	3,006,928		0.040
interLATA DEMs, thousands	12,266,000		0.162

**BEFORE THE ARIZONA CORPORATION COMMISSION**

**IN THE MATTER OF )**  
**INVESTIGATION INTO QWEST )**  
**CORPORATION'S COMPLIANCE ) DOCKET NO. T-00000A-00-0194**  
**WITH CERTAIN WHOLESAL )**  
**PRICING REQUIREMENTS FOR )**  
**UNBUNDLED NETWORK )**  
**ELEMENTS AND RESALE )**  
**DISCOUNTS )**

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**REBUTTAL TESTIMONY OF DANIEL KELLEY**

**ON BEHALF OF**

**AT&T COMMUNICATIONS OF THE MOUNTAIN STATES, INC.,**

**AND WORLDCOM, INC.**

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**SEPTEMBER 27, 2001**

1 **Q. PLEASE STATE YOUR NAME.**

2 A. My name is Daniel Kelley.

3

4 **Q. BY WHOM ARE YOU EMPLOYED AND WHAT IS YOUR TITLE?**

5 A. I am employed by HAI Consulting. My title is Senior Vice President.

6

7 **Q. PLEASE DESCRIBE YOUR PROFESSIONAL EXPERIENCE.**

8 A. My professional experience began in 1972 at the Antitrust Division of the U.S.  
9 Department of Justice where I analyzed mergers, acquisitions and business  
10 practices in a number of industries, including telecommunications. While at the  
11 Department of Justice, I was a member of the economics staff of U.S. v. AT&T.  
12 In 1979, I moved to the Federal Communications Commission ("FCC") where I  
13 held positions as Senior Economist in the Common Carrier Bureau and the Office  
14 of Plans and Policy, and also served as Special Assistant to the Chairman. After  
15 leaving the FCC, I was a Project Manager and Senior Economist at ICF,  
16 Incorporated, a public policy consulting firm. From September 1984 through July  
17 of 1990, I was employed by MCI Communications Corporation as its Director of  
18 Regulatory Policy. At MCI, I was responsible for developing and implementing  
19 MCI's public policy positions. In August of 1990, I joined Hatfield Associates,  
20 Inc. (the predecessor of HAI) as Senior Vice President. In my current position, I  
21 conduct economic and policy studies on a wide variety of telecommunications  
22 issues, including dominant firm regulation, local exchange competition, and the

1 cost of local service. I have advised foreign government officials on  
2 telecommunications policy matters and have taught seminars in regulatory  
3 economics in a number of foreign countries.  
4

5 **Q. PLEASE DESCRIBE YOUR EDUCATION.**

6 A. I received a Bachelor of Arts degree in Economics from the University of  
7 Colorado in 1969, a Master of Arts degree in Economics from the University of  
8 Oregon in 1971 and a Ph.D. in Economics from the University of Oregon in 1976.  
9

10 **Q. HAVE YOU PUBLISHED RESEARCH IN ECONOMICS?**

11 A. Yes, I have published articles in antitrust and telecommunications economics. A  
12 copy of my resume is attached as Exhibit DK-R1.  
13

14 **Q. HAVE YOU TESTIFIED PREVIOUSLY?**

15 A. Yes, I have testified on telecommunications issues before the California,  
16 Colorado, Connecticut, Florida, Georgia, Hawaii, Maryland, Massachusetts,  
17 Michigan, New Jersey, New York, Oregon, Pennsylvania, Utah and Washington  
18 Commissions, as well as the Federal Communications Commission and the State-  
19 Federal Joint Board investigating universal service reform.  
20

21 **Q. WHAT IS THE PURPOSE OF YOUR TESTIMONY?**

22 A. I have been asked by AT&T Communications of the Mountain States, Inc. and  
23 WorldCom, Inc. to respond to portions of the June 27, 2001 Rebuttal Testimony

1 of Garrett Y. Fleming on behalf of Qwest Corporation (“QWEST”). Specifically,  
2 I have been asked to address economic issues raised by Mr. Fleming’s discussion  
3 of the HAI estimates of the economic cost of local switching. My colleague  
4 Richard Chandler is addressing technical issues raised by Mr. Fleming’s  
5 testimony.

6

7 **Q. WHAT ARE MR. FLEMING’S PRINCIPAL CONCERNS WITH THE HAI**  
8 **SWITCHING ESTIMATES?**

9 A. Mr. Fleming maintains that the HAI switching cost estimates are understated  
10 because the HAI 5.2a bases its approach on the algorithm developed by the FCC.  
11 Mr. Fleming raises two specific objections to the FCC switching methodology.  
12 The first is that the FCC does not include the “. . . ongoing upgrade investments  
13 necessary to keep a switch technologically current once it is installed” in its  
14 TELRIC investment. The second is that the FCC does not include the “. . . costs  
15 of those lines that need to be added to a switch as customer demand increases  
16 over the life of the switch.” [Fleming Rebuttal, p. 84]

17

18 **Q. ARE MR. FLEMING’S CONCERNS LEGITIMATE?**

19 A. No. The proper application of TELRIC principles excludes from forward looking  
20 switching costs both ongoing upgrade costs and the costs of adding new lines.  
21 Calculating forward-looking switching costs in this way does not prevent Qwest  
22 from making any necessary or prudent investment in capacity to meet future  
23 needs.

1 **Q. WHAT DID THE FCC CONCLUDE REGARDING UPGRADE COSTS?**

2 A. The FCC considered and rejected arguments from ILECs including Qwest that  
3 upgrade costs should be included in its USF Inputs Order, CC Docket No. 96-45,  
4 Released November 2, 1999 (“Inputs Order”). Specifically, the FCC found that:

5 The model platform we adopted is intended to use the most cost-  
6 effective, forward-looking technology available at a particular  
7 period in time. The installation costs of switches estimated above  
8 reflect the most cost-effective forward-looking technology for  
9 meeting industry performance requirements. Switches, augmented  
10 by upgrades, may provide carriers the ability to provide supported  
11 services, but do so at greater costs. Therefore, such augmented  
12 switches do not constitute cost-effective forward-looking  
13 technology. In addition, as industry performance requirements  
14 change over time, so will the costs of purchasing and installing  
15 new switches. The historical cost data employed in this analysis  
16 reflect such changes over time, as do the time-trended cost  
17 estimates. [¶ 317, footnotes omitted]

18  
19  
20 **Q. WHY ARE ONGOING UPGRADE COSTS PROPERLY EXCLUDED**  
21 **FROM FORWARD-LOOKING SWITCHING COSTS?**

22 A. The FCC’s TELRIC methodology, which is based on the economic concept of  
23 Total Service Long Run Incremental Cost, does not incorporate technical  
24 advances that are not yet available to or widely used by local telephone  
25 companies. Thus, the cost of switch upgrades that have not yet been released are  
26 properly excluded from the charges that current customers must pay. Moreover,  
27 as the FCC notes in the paragraph quoted above, an upgraded older generation  
28 switch may be less cost effective than a new switch that includes the features and  
29 functions that the upgrade provides.

30

1 **Q. DOES MR. FLEMING ENDORSE INCLUDING UNDEPLOYED**  
2 **TECHNOLOGY ELSEWHERE IN HIS TESTIMONY?**

3 A. No. He specifically rejects this approach. He points out that “prices based on the  
4 cost of a hypothetical network or system designs that have never actually been  
5 deployed would ultimately impact the investment decisions of all parties in the  
6 market.” [Fleming Rebuttal, p. 11] The HAI switching estimates are based on  
7 technology, equipment, and architectures that are being deployed by telephone  
8 companies today. Including the effect of hypothetical upgrades would not be  
9 appropriate.

10

11 **Q. MR. FLEMING ALSO SEEMS TO ARGUE THAT THE FCC APPROACH**  
12 **IS DEFECTIVE BECAUSE THE COST OF SWITCH UPGRADES MADE**  
13 **SINCE THE FCC’S DATA WERE GATHERED ARE NOT INCLUDED.**  
14 **[P. 84] DO YOU AGREE?**

15 A. No. The FCC used the best available data. These data are based on historical  
16 depreciation information filed by the local telephone companies. The data were  
17 used to build a regression equation that captures cost trends for a new switch,  
18 including adjustments for inflation and productivity changes. The adjustments are  
19 designed to account for changes in switching costs that have occurred since the  
20 data were gathered. As the Commission noted in its Inputs Order, “U S West  
21 agrees that the costs of the equipment such as switches and multiplexers, used to  
22 provide telecommunications services are declining, and that the per-unit cost of  
23 providing more services on average is declining.” [Inputs Order, ¶ 313] If Qwest

1 has better data that can be verified by third parties, it should have been made  
2 available to this Commission and interested parties by now. Certainly Qwest has  
3 the incentive to bring forth data that support its positions. I would also note that  
4 the FCC attempted to gather additional information through data requests to the  
5 large telephone companies, but did not receive usable information. [See Inputs  
6 Order, ¶ 301]

7  
8 **Q. ARE THERE OTHER REASONS TO EXCLUDE UPGRADE COSTS?**

9 A. Yes. Upgrades are made for a variety of reasons and have a variety of effects.  
10 For example, an upgrade might result in more efficient switch operation resulting  
11 in lower operating expenses. An upgrade might also enable the switch to perform  
12 functions that are the basis for new services for which Qwest could derive  
13 revenue from third parties. Adding upgrade costs to the cost of the switching  
14 UNE without taking into account the effect of the upgrade on other costs or  
15 revenues would not be appropriate because the change would be partial and could  
16 lead to inconsistencies. Even Mr. Fleming recognizes that “a comprehensive and  
17 consistent approach to analyzing inputs and assumptions is critical to arriving at  
18 reasonable conclusions regarding inputs and assumptions.” [Fleming Rebuttal, p.  
19 10] Moreover, I would note that upgrades can have the effect of extending the  
20 life of a switch well beyond the 10-year economic life used in the Model. Some  
21 1AESS switches were in service for decades because they were upgradable. If the  
22 cost of potential upgrades were to be included, then the lives of switches would  
23 have to be lengthened considerably. Finally, there is no guarantee that Qwest will

1 continue to make upgrades. Mr. Fleming admits that at one time U S West was  
2 four generics behind in its upgrades. [Fleming Rebuttal, p. 88] Qwest could  
3 decide to stop investing in its network once again.  
4

5 **Q. ARE UPGRADES A LEGITIMATE COST OF DOING BUSINESS?**

6 A. Certainly. But that does not mean the anticipated cost should be included in a  
7 TELRIC model. Proxy models are useful precisely because they allow the  
8 Commission to focus on the costs of efficiently providing the particular facilities  
9 needed to serve current demand. The existing local telephone company networks  
10 were built over a period of years to provide a variety of regulated and unregulated  
11 services. Modeling a network optimized to provide the precise services that  
12 Qwest is required to unbundle under the 1996 Act and determining the TELRIC  
13 of those services is a different exercise than modeling the Qwest legacy network,  
14 which has been designed to advance Qwest's long term strategic business  
15 interests.  
16

17 **Q. SHOULD THE COST OF PROVIDING GROWTH LINES BE INCLUDED**  
18 **IN THE SWITCHING COST ESTIMATES?**

19 A. No. TELRIC is designed to estimate the cost of providing the current level of  
20 demand. Including the cost of capacity needed to serve future demand would  
21 unfairly and uneconomically burden today's customers. In other words, to do so  
22 would result in an intergenerational cross-subsidy. Today's customers would be  
23 paying for capacity designed to serve tomorrow's customers.

1 **Q. WHY WOULD A TELEPHONE COMPANY WANT TO ENGAGE IN**  
2 **SUCH A CROSS-SUBSIDY?**

3 A. There is less competition today than there may be at a later date. By forcing  
4 current customers to bear the costs for expansion designed to serve future  
5 customers, the local telephone company can both earn higher current margins and  
6 raise its current rivals' costs.

7  
8 **Q. WOULD A COMPETITIVE FIRM ENGAGE IN THIS TYPE OF**  
9 **BEHAVIOR?**

10 A. No. A competitive firm would be unable to do so. Suppose an automobile  
11 manufacturer anticipates growing demand and builds a manufacturing plant with  
12 capacity to build 150 percent of today's demand. If this firm were to attempt to  
13 recover the cost of carrying the excess capacity from its current customers it  
14 would fail. Consumers would turn to other manufacturers who would be quite  
15 willing to base their prices on the cost of serving current demand. This does not  
16 mean the auto manufacturer is irrational for building excess capacity. In the long  
17 term it is better off for having done so. The total cost over time of serving both  
18 current and future demand will be reduced because it enjoys economies of scale  
19 with the larger plant.

20

21 **Q. ARE THERE LEGITIMATE CONCERNS ABOUT THE COST OF**  
22 **GROWTH LINES VERSUS THE COST OF LINES INITIALLY**  
23 **INSTALLED WITH THE SWITCH?**

1 A. Possibly yes. If switch vendors are engaging in a razor and razor blades strategy  
2 – charging a relatively low price for initial lines and a relatively high price for  
3 growth lines, then it would be appropriate to somehow average the cost of initial  
4 and growth lines. However, Mr. Fleming does not provide data to show that this  
5 is in fact the case. As Mr. Chandler’s rebuttal testimony shows, Qwest’s model  
6 inputs show the same cost for initial and growth lines. The SCM inputs show a  
7 higher discount for ‘non-getting-started’ investment and a constant discount for  
8 line circuits.

9

10 **Q. MR. FLEMING ALSO COMPLAINS ABOUT FILL LEVELS IN THE HAI**  
11 **MODEL? DO YOU HAVE A COMMENT?**

12 A. Yes. Mr. Fleming complains that the 94 percent switching fill factor used in the  
13 model is too high because it does not reflect lines needed for growth. [Fleming  
14 Rebuttal, p. 92] This appears to be the analytical equivalent to the growth line  
15 problem discussed above. The proper fill level in a TELRIC model is one that  
16 allows efficient current operation. Capacity beyond that level should not be  
17 included in TELRIC rates. The FCC adopted the 94 percent number in the Inputs  
18 Order. [¶ 330] In arriving at that number, the FCC specifically rejected U S West  
19 arguments in favor of a lower fill factor. The FCC found that “U S West’s  
20 average fill factor of 78 percent is based on data that include switches with  
21 unreasonably low fill factors.” [¶ 332]. In particular the FCC notes that seven U S  
22 West switches had a combined fill factor of .027 percent. [fn. 1072]

1 **Q. HOW DO YOU EXPLAIN THE LOWER FILL LEVELS IN THE QWEST**  
2 **NETWORK?**

3 A. There are three possible explanations. First, the extra capacity may be installed  
4 for future use. Second, the capacity may be the result of inefficiency. Third,  
5 switches may have just come on line and have not reached planned usage levels or  
6 switches may be in the decommissioning process. If the capacity is for future use,  
7 then it is entirely appropriate for Qwest to build it into its network. What is not  
8 appropriate is to charge today's customers for tomorrow's usage.

9

10 **Q. IS THERE PRECEDENT FOR CHARGING FOR CAPACITY BASED ON**  
11 **HOW IT IS USED OVER TIME?**

12 A. Yes. That is exactly the role that depreciation plays. The cost of a capital  
13 investment is spread over the economic life of the asset. Even though Qwest may  
14 buy a switch today, it does not charge the full cost of the switch to today's  
15 customers. It has bought capacity to serve tomorrow's customers as well.  
16 Similarly, even though Qwest may have purchased the switch with enough line  
17 capacity to serve demand some years in the future, it should not charge current  
18 customers for any of the cost of that excess capacity. The proper economic  
19 treatment of the investment is to include capital costs for capacity needed to serve  
20 today's demand in today's rates and defer the depreciation and return on excess  
21 capacity to the time when that capacity is used. This means that the economic  
22 treatment of the asset may differ from the accounting treatment.

1 **Q. MR. FLEMING ARGUES THAT AN ACCOUNTING ANOMALY MAY**  
2 **HAVE AFFECTED THE FCC'S RESULTS. DO YOU HAVE A**  
3 **COMMENT?**

4 A. Mr. Fleming maintains that since 1992 the cost of applications software has been  
5 booked to a capital account while other large telephone companies expense it.  
6 [Fleming Rebuttal, p. 93]. The implication is evidently that the HAI costs are  
7 understated because the FCC does not pick up this expense in its switching cost  
8 data and HAI does not include it in its switching operating expense data.  
9 Application software that was purchased with a new switch would have already  
10 been included in the FCC depreciation data and is included. Moreover, the FCC  
11 used data from multiple telephone companies. In any event, the FCC expense  
12 ratio, which is used to produce the HAI Arizona results, is quite conservative. I  
13 would also note that the fact that different telephone companies use different  
14 accounting assumptions and change them over time is just one more reason why  
15 external models provide a better basis for cost estimation than company  
16 embedded accounting data.

17  
18 **Q. DOES MR. FLEMING RAISE OTHER SWITCHING COST ISSUES?**

19 A. Yes. Mr. Fleming maintains that "the HAI 5.2a does not include many vertical  
20 feature related costs. These are the application software costs, SS7 costs and  
21 some feature hardware related costs." He also maintains that "since the early  
22 1990's, when those depreciation reports were filed with the FCC, input/output  
23 ports, recorded announcements and conference circuits have had to be added due

1 to new features and increased demand for existing features. So clearly the FCC  
2 Switch Algorithm does not include these investments.” [Fleming Rebuttal, p. 98]

3

4 **Q. HOW DO YOU RESPOND?**

5 A. All capitalized investment, including applications software and feature hardware,  
6 are included in the FCC’s price inputs. The hardware items he discusses were in  
7 the FCC’s prices and the trending regression the FCC used would have captured  
8 their growth, if any.

9

10 **Q. MR. FLEMING STATES THAT THE LARGE GAP BETWEEN**  
11 **FORWARD LOOKING INVESTMENT AND EMBEDDED INVESTMENT**  
12 **PROVES THAT THE HAI MODEL UNDERSTATES COST. [p. 83] DO**  
13 **YOU HAVE A COMMENT?**

14 A. Yes. There are a number of reasonable explanations for the gap between forward-  
15 looking and embedded investment. First, embedded fill factors are inefficiently  
16 low. Mr. Fleming notes that the digital line fill factor is only 43 percent [Fleming  
17 Rebuttal, p. 91]. As demand grows, Qwest will realize the benefits of this low  
18 fill. Second, Qwest may be operating too many switches – the FCC’s TELRIC  
19 assumption preserves existing switch locations but not the number of switches.  
20 Third, switching capacity may have been retired but not yet removed from the  
21 books. Fourth, Qwest may have invested in substantial capacity in anticipation of  
22 serving Centrex customers that either were not acquired or were lost to PBXs.  
23 Finally, the cost of switches has fallen. Mr. Fleming disputes the extent to which

1 switch prices have fallen. [Fleming Rebuttal, p. 83] However, switches are  
2 basically special purpose digital computers. The cost of computer processing  
3 capacity has obviously fallen substantially in the past decade. The USTA UNE  
4 Fact Report (submitted by USTA to the FCC May 26, 1999 on behalf of  
5 Ameritech, Bell Atlantic, BellSouth, GTE, SBC and US WEST) stated that “on a  
6 per-line basis, prices declined over 60 percent from 1986 to 1996 and were  
7 projected to fall another 12 percent by 2000.”

8

9 **Q. DOES THIS CONCLUDE YOUR TESTIMONY?**

10 A. Yes, it does.

## **Exhibit DK-R1**

**Daniel Kelley**

### **PROFESSIONAL EXPERIENCE**

#### **Senior Vice President, HAI Consulting, Inc., Boulder Colorado, current position.**

Conducting economic and applied policy analysis of domestic and international telecommunications issues. Recent assignments include investigation of broadband competition and interconnection, antitrust analysis of local telephone company mergers, and costing and interconnection studies in various countries. Other assignments have included analysis of competitive conditions in wireless markets, the economics of cable television regulation, analysis of the prospects for local telephone competition, and measuring the economic cost of local service.

#### **Director of Regulatory Policy, MCI Communications Corporation, 1984-1990.**

Responsible for developing and implementing MCI's public policy positions on issues such as dominant carrier regulation, Open Network Architecture, accounting separations and Bell Operating Company line of business restrictions. Also managed an interdisciplinary group of economists, engineers and lawyers engaged in analyzing AT&T and local telephone company tariffs.

#### **Senior Economist and Project Manager, ICF Incorporated, 1982-1984.**

Telecommunications and antitrust projects included: forecasting long distance telephone rates; analysis of the competitive effects of AT&T's long distance rate structures; a study of optimal firm size for cellular radio markets; analysis of the FCC's Financial Interest and Syndication Rules, and competitive analysis of mergers and acquisitions in a variety of industries.

#### **Senior Economist, Federal Communications Commission, 1979-1982.**

Served as Special Assistant to the Chairman during 1980-1981. Advised the Chairman on proposed regulatory changes in the broadcasting, cable television and telephone industries; analyzed legislation and drafted congressional testimony. Coordinated Bureau and Office efforts on major common carrier matters such as the Second Computer Inquiry and the Competitive Carrier Rulemaking. Also held Senior Economist positions in the Office of Plans and Policy and the Common Carrier Bureau.

#### **Staff Economist, U.S. Department of Justice, 1972-1979.**

Analyzed proposals for restructuring the Bell System as a member of the economic staff of U.S. v. AT&T; investigated the competitive effects of mergers and business practices in a wide variety of industries.

## EDUCATION

1976	Ph.D. in Economics	University of Oregon
1971	M.A. in Economics	University of Oregon
1969	B.A. in Economics	University of Colorado

## PAPERS AND COMPLETED RESEARCH

"New Zealand Telecommunications: The State of Competition" (1998), with Todd Telecommunications Consortium.

"Cable and Wireless Alternatives to Residential Local Exchange Service," Berkeley Conference on Convergence and Digital Technology (1997), with Alan J. Boyer and David M. Nugent.

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"An Empirical Survey of Price Fixing Conspiracies," Journal of Law and Economics (1974), with George A. Hay. Reprinted in Siegfried and Calvari, ed., Economic Analysis and Antitrust Law (1978) and the Journal of Reprints for Antitrust Law and Economics (1980).

## **TESTIMONY BEFORE REGULATORY AGENCIES**

Federal Communications Commission, Application of Cellular Communications of Cincinnati, July 25, 1983 (with Robert J. Reynolds): Optimum firm size in the cellular radio market.

Maryland Public Service Commission, Case No. 0450-Phase II, May 31, 1983: Access charge implementation issues.

New York Public Service Commission, Case No. 28425, June 1983: Access charge implementation issues.

Florida Public Service Commission, Docket No. 820537-TP, June 30, 1983, November 4, 1983, April 9, 1984, June 4, 1984, September 7, 1984, October 25, 1984 and August 15, 1985: Access charge implementation issues.

Pennsylvania Public Utility Commission, Docket No. R-832, August 5, 1983: Rate Case.

New Jersey Board of Public Utilities, Docket No. 83-11, February 20, 1984: Access Charge.

New York Public Service Commission, Case 88-C-102, March 2, 1990: Alternative Operator Service Issues.

California Public Service Commission, A.90-07-015, July 10, 1990: AT&T Deregulation.

New York Public Service Commission, Case 28425, October 8, 1990: IntraLATA Dial 1 Competition.

Massachusetts Department of Public Utilities, DPU 90-133, October 17, 1990: AT&T Deregulation.

Georgia Public Service Commission, 3905-U, November 16, 1990: Incentive Regulation.

California Public Service Commission, I-87-11-033, September 23, 1991: IntraLATA Competition.

Georgia Public Service Commission, Docket No. 3987-U, January 31, 1992: Cross-Subsidy.

Colorado Public Utilities Commission, Docket No. 92R-050T, August 24, 1992: Collocation.

Connecticut Department of Public Utility Control, Docket No. 9106-10-06, September 25, 1992: Infrastructure.

Maryland Public Service Commission, Case No. 8584, Phase II, July 21, 1995: Local Competition.

Connecticut Department of Public Utility Control, Docket No. 95-06-17, September 8, 1995: Local Competition .

Federal-State Joint Board on Universal Service, CC Docket No. 96-45, June 5, 1996: Cost Modeling.

**TESTIMONY (CONT'D)**

Colorado Public Utilities Commission, Docket No. 96A-287T, September 6, 1996: Arbitration.

Hawaii Public Utilities Commission, October 17, 1996: Arbitration.

Oregon Public Service Commission, Dockets ARB 3 & 6, September 6, 1996: Arbitration.

Michigan Public Service Commission, October 24, 1996: Arbitration.

New York Public Service Commission, Case No. 28425, May 9, 1997: Access Charges.

Colorado Public Utilities Commission, Docket No. 97F-175T, July 18, 1997: Access Charges.

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