Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

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In the Matter of	)	
	)	CC Docket No. 96-45
Federal-State Joint Board on Universal Service	)	

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FURTHER COMMENTS OF AT&T CORP.

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SUMMARY

A valid model of the costs associated with the basic local services at issue in this proceeding must satisfy three requirements. First, it must focus on the costs attributable to efficient provision of *those* basic services, and not the costs of a network designed to provide broadband, advanced narrowband, or other non-basic services. Second, a valid model must estimate forward-looking *economic* costs – the costs that trigger competitive market entry and exit decisions, and thus the costs upon which universal service subsidies must be based if consumers are to receive the full competitive benefits of the Telecommunications Act of 1996. Third, a viable model must be flexible and have a sufficiently modular, open design to allow effective application in all areas.

Only one of the models identified in the Commission's notice – the Hatfield Model – satisfies these standards. Relying on well documented inputs and conservative engineering assumptions, the Hatfield model produces realistic estimates of the efficient forward-looking costs of supplying basic services (and basic network elements as well). The outputs of the model are highly disaggregated, and the modular, open architecture of the model permits user adjustment of virtually all significant input default values.

The BCM, BCM2, and CPM models, in contrast, are riddled with conceptual flaws and unverifiable, unrealistic and often unchangeable inputs. Without significant further adjustment, the original BCM was not designed to develop the cost of basic telephone service, as its sponsors admit. Rather, BCM estimates only loop and switching capital costs; the costs of other facilities, and the forward looking expenses associated with all facilities, are derived from lump sum multipliers. BCM also suffers from limitations in its assumptions about network architecture, and improperly attributes to basic services the costs of massive spare capacity that is properly attributable to long distance, broadband, and other services.

BCM2, while purporting to avoid some of BCM's limitations, generates cost estimates that are even wider of the mark. BCM2 models an oversized and needlessly costly network, relies on arbitrary and unrealistic assumptions about network architecture, and continues to address many significant costs only through crude add-ons and multipliers. The BCM2's refinements to BCM are less sophisticated and detailed than the corresponding adjustments made by the Hatfield model, or involve cost elements that have little significance.

The CPM is a black box, little more than a spreadsheet of values based on proprietary data, undocumented judgments and assumptions, and other unverifiable sources. Enough is verifiable about the CPM, however, to make clear that its cost estimates are historical, not forward-looking, reflect the excess capacity and inflated costs of the Pacific Bell network, and contain arbitrary and unjustified inputs and adjustments.

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Pursuant to the Commission's Notice of July 10, 1996, AT&T Corp. ("AT&T") submits these further comments on issues relating to the cost models that parties have advocated in this proceeding as tools for implementing the universal service provisions of the Telecommunications Act of 1996 ("Act"). More specifically, these comments address the Cost Proxy Model ("CPM") submitted by Pacific Telesis ("PacTel"), two versions of the Benchmark Cost Model ("BCM" and "BCM2") submitted by US West and Sprint Corporation, among others, and the Hatfield Model submitted by AT&T and MCI Communications, Inc. ("MCI").

The submitted models take very different approaches to cost measurement, and each of the models has different structures, capabilities and limitations. Accordingly, to evaluate the models' suitability for universal service cost analyses, it is necessary first to establish both what costs that a model should measure and what cost principles such a model should apply in measuring them.

As the Commission makes clear in the notice, the costs that any model should measure are the costs of "supplying basic residential telephone service."[1] The costs a model should *not* measure are the costs of supplying enhanced or broadband services or maintaining spare capacity to respond to other present or potential future opportunities. The Commission should therefore reject any model that fails vigilantly to apply efficient narrowband design principles and to isolate the costs associated with the basic local services at which universal service affordability policies are targeted. Otherwise, the laudable goal of maintaining affordable basic telephone services would be subverted by enormously costly cross-subsidies to certain local service providers.

Similarly, as AT&T explained in its Initial and Reply Comments and as the Commission recently recognized in its landmark decision in CC Docket Number 96-98, the costing principles that should be applied to avoid cross-subsidies and barriers to entry and efficient competition are *economic* costing principles.[2] Only with a model that adheres faithfully to forward-looking total service, or element, long run incremental cost principles ("TSLRIC" and "TELRIC," respectively) can regulators keep subsidies – which all agree must be minimized if effective competition is to develop – to the minimum levels necessary to encourage local service providers to continue to provide affordable basic services in the nation's high cost areas. In this regard, consistency between prices, costs and subsidies is also critically important if artificial barriers to entry and

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[1] As AT&T noted in its Initial Comments (at p. 12), for the present, the core services funded by universal service subsidies should be limited to "voice grade dial tone, touch tone, residential single party service, access to emergency (911) and operator services, directory information (411), white pages directory listing, local usage in a limited calling area, equal access to long distance service, and local number portability."

[2] CC Docket No. 96-98, *Implementation of the Local Competition Provisions of the Telecommunications Act of 1996* (released August 8, 1996) ("*Section 251 Order*").

barriers to effective competition are to be avoided, and thus the chosen costing model must be sufficiently flexible to account for local variances.

A universal service cost model then should do three things well: (1) measure the costs associated with a network designed to provide basic local services, not the oversized and over-designed networks that certain ILECs have chosen to build in anticipation of potential future opportunities or to reap the excess returns available from overbuilding under rate of return regulation; (2) conform, to the extent practicable, with the economic costing principles that trigger and sustain competitive market entry and exit decisions and upon which the Commission must base universal service subsidies if it is to avoid creating entry barriers; and (3) have sufficient flexibility through user adjustable inputs and a modular, open architecture design to be suitable for regulators to use in all areas. The Hatfield Model, alone among the costing models submitted to the Commission in this proceeding, meets these demanding standards. It has the added benefit of providing a single consistent framework for the costing and pricing of both basic local residential services and unbundled network elements, a range of capabilities that sponsors of the other models expressly disavow.

I. THE HATFIELD MODEL

The Hatfield Model, developed by Hatfield Associates, Inc., under the sponsorship of AT&T and MCI, is a flexible, publicly-available engineering model that estimates the economic costs of providing basic narrowband telephone services to consumers in any and all geographic areas in the United States. In its current release,[3] the model, which incorporates three

[3] An electronic version of sample outputs of the latest release of the Hatfield Model (Version 2.2 Release 2, or "Release 2") is being submitted with these comments. A description of Release

(footnote continued on following page)

components of a BCM derivative, BCM +,[4] provides a variety of geographically deaveraged outputs, including both the economic costs associated with providing basic network elements and the economic costs of supplying basic local services. These latter outputs, which reflect the universal service origins of the Hatfield Model,[5] include for each of six density zones in each LEC

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2's key enhancements is attached as Appendix A. AT&T and MCI intend to provide the Commission with an electronic version of Release 2, related documentation, and additional outputs by August 16, 1996 in connection with its responses to the Commission's data requests. Parties or others will be able to obtain electronic copies of Release 2 directly from ITS as stated in the Commission's notice.

In accordance with Hatfield's software numbering conventions, Release 2 is designated "2.2.2." The first digit signifies that the model can produce network element cost outputs, and not just universal service cost outputs (which would be designated by a first digit of 1). The second digit indicates whether the model employs a "scorched earth" (1) or a "scorched node" (2) network design assumption (*i.e.*, whether the model accepts existing LEC wire center locations as a given), and the third digit signifies the release number of the version employing those assumptions.

[4] BCM +, developed and copyrighted by MCI, an original BCM sponsor, reflects significant improvements to the original BCM model. Among other things, BCM + replaces a number of the BCM model's "hard-wired" input assumptions with user-adjustable inputs, uses 1995 (rather than 1990) household data, bases density zone categories on the number of lines (rather than the number of households) in a CBG, and modifies BCM to more directly estimate business lines and loop structure and installation costs, vary the number of distribution cables by density zone and adjust cable distances in light of soil type. A more comprehensive list of BCM + enhancements is included in the Release 2 enhancement summary attached as Appendix A.

[5] The original Hatfield Model (Version 1.1), sponsored by MCI in 1994, provided universal service outputs based on a number of simplifying assumptions (including "scorched earth" wire center location algorithms, homogenous population density zones and no direct interoffice trunking). Version 1.2, introduced in late 1995 to gauge Pennsylvania universal service needs, replaced the scorched earth algorithms with a "scorched node" approach that reflects the location of existing LEC wire centers. As noted above, Release 2 produces both network element and universal service outputs, and reflects further refinements to the model made during the development of its network element costing capabilities, including geographic deaveraging, the inclusion of interoffice trunking investments (and other costs of providing basic local service that were left out of the BCM model) and other important adjustments to BCM inputs and outputs that reflect many of the same concerns recognized by the BCM's ILEC sponsors.

serving area a breakdown of the costs associated with local usage, white pages, billing and collection, variable support expenses, and local number portability -- in short, everything required to perform detailed and comprehensive universal service analyses.

The Hatfield Model, like any comprehensive modeling tool, uses a number of data inputs. The engineers and economists at Hatfield have selected values for those input, where possible, from publicly available information, and the national average default input values are well documented and conservative. Further, the Hatfield Model's modular and open architecture, in which the vast majority of critical data inputs are user adjustable,[6] allows users to modify data inputs as necessary to reflect new or state-specific data. Thus, for example, Hatfield's default cost of capital inputs can easily be changed to reflect cost of capital estimates that users are able to justify. The model thus provides regulators and parties maximum flexibility in calculating universal service costs (and any differences between those costs and rates deemed affordable) in a competitively neutral manner consistent with the Act's goal of fostering local services competition.

The Hatfield Model processes these data inputs through seven functional calculation modules to produce the relevant local service cost estimates.[7] *First*, the Input Data File, a component of BCM + that expands upon the data capabilities of the BCM model, collects and maintains data for use in other Hatfield modules. This extensive database includes, *inter alia*,

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[6] A list of Release 2's user definable data inputs, and the current national average default values for those inputs, is attached hereto as Appendix B. Of course, it may be appropriate in some states to substitute state specific inputs for the national average defaults.

[7] Software and accounting professionals from the firm Deloitte & Touche have extensively tested and validated the Hatfield Model code.

Census Block Group ("CBG") data from the U.S. Census Bureau updated to reflect 1995 population estimates (including numbers of households, land areas, local geological factors, and position data used to relate individual CBGs to LEC wire centers), Bellcore Local Exchange Routing Guide ("LERG") and NECA Tariff 4 Common Language Location Identifier ("CLLI") data (which together define existing LEC wire center locations), U.S. Geological Service Satellite Survey Data (used in calculating loop installation costs) and Dun and Bradstreet census tract business employee counts (used to estimate business lines).

Second, the Line Converter Module developed by Hatfield estimates the total number of access lines in each CBG – thereby allowing the Hatfield Model to engineer a network that can satisfy *all* significant sources of basic narrowband demand for local network facilities, including residence, business, and public and special access lines.[8] To generate access line counts at the CBG level, the Line Converter Module first assigns the total residential access lines reported by each LEC in its 1995 Operating Data Report (ARMIS 43-08) to CBGs on the basis of number of households (as reported in the Input Data File).[9] The module then assigns the total business, public and special access lines reported in the 1995 Operating Data Reports to individual CBGs on the basis of the number of people who work in each CBG (again from the Input Data File).[10]

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[8] Because of this engineering assumption, the Hatfield Model reflects in universal service costs a reasonable share of the scale efficiencies of the local network.

[9] Claims that the Hatfield Model's *pro rata* allocation of second residential lines understates loop costs because a LEC cannot know in advance which customers will order a second line are meritless. The Hatfield Model's drop investment calculations assume that *every* residence drop includes two pairs, and thus that any customer's second line request can be accommodated.

[10] AT&T has repeatedly asked ILECs to disclose the *actual* numbers of residence, business, public and special access lines on a CBG or wire center basis. The ILECs have refused to provide that information. If the ILECs disclosed this information, the Hatfield Model could use those figures as inputs.

Third, the Data Module, which uses a component of BCM +, calculates feeder, sub-feeder and distribution cable lengths (by segment) required to serve the total access lines in each CBG. The Data Module bases these loop length calculations on geometric and trigonometric functions and a series of network design assumptions. The original BCM developers assumed that: (1) feeder cable ends (and distribution cable begins) at the edge of the CBG; (2) four main feeder routes leave each wire center with subfeeder routes placed at 90 degree angles from the main feeder routes; (3) distribution cables extend from the edge of the CBG to each customer premises; (4) households are distributed evenly throughout a CBG; and (5) four distribution legs are used to serve each CBG. Hatfield's Data Module (through its use of BCM +) makes two important design refinements. First, to reflect more efficient engineering practices the module assumes that feeder/distribution cable thresholds occur one quarter *into*, rather than at the edge, of CBGs. Second, the Data Module recognizes that the number of distribution legs installed by an efficient local service provider may vary with density and therefore replaces the BCM assumption of four equal length distribution legs with a more realistic variable approach (with up to eight distribution legs in the highest density CBGs).

Fourth, the Loop Module, which also uses a component of BCM +, produces a loop materials cost estimate for each CBG. Because Hatfield is a "bottoms-up" forward-looking engineering model, the Loop Module relies on inputs specifying the types of local network components used and their purchase prices, as well as network parameters such as plant utilization or "fill" levels and the relative percentages of buried, underground (*i.e.*, cable in duct) and aerial cable.[11] Virtually all of these inputs are user adjustable. In this regard, the Loop

[11] The BCM models, by contrast, do not distinguish between buried and underground cable.

Module represents a substantial improvement over the BCM and CPM approaches which "hard-wire" many assumptions relating, *inter alia*, to copper/fiber thresholds (*i.e.*, the distances at which it becomes cost effective to install fiber and/or digital loop carrier equipment ("DLC")), fiber capacities, and available cable sizes. The Loop Module first determines the efficient feeder technology (i.e. copper, fiber, or combination) based on the distance from the relevant wire center to each CBG and the copper/fiber threshold input. Next, the module determines the required feeder capacity to accommodate the cumulative capacity requirements along the route based on Data Module outputs, cable fill factor inputs,[12] and BCM + algorithms. The module then determines types and quantities of distribution and feeder cable based on copper/fiber threshold, cable size, aerial/buried/underground cable mix and other inputs and BCM + algorithms. Finally, the Loop Module estimates a per foot loop materials investment (including DLC)[13] based on user adjustable list price and discount inputs.

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[12] Certain ILECs complain that Hatfield's fill assumptions, which range from 50 to 80 percent – *i.e.*, 20 to 50 percent of capacity is assumed available for growth, breakage, etc. – produce a more heavily filled network than the ILECs' embedded networks. But it is precisely the strategic ILEC decisions reflected in embedded data – *i.e.*, overbuilding network facilities to meet potential future enhanced and broadband service demand – for which any forward-looking basic local service costing model *must* correct if it is to provide meaningful results. Excess capacity installed to provide ILEC enhanced and video and other broadband services must be supported by these other revenue sources, and those investments are plainly irrelevant in determining appropriate universal service subsidies. Further, Hatfield did not simply ignore ILEC-reported fill data; to the contrary, where the BCM fill assumptions reasonably approximated efficient design practices (as they did, for example, for digital loop carrier), Hatfield used them. Further, the *effective* fill rates assumed by the Hatfield Model are, in most cases, significantly lower than the input values, because the Hatfield cable sizing algorithm always assigns the next largest cable size – *e.g.*, if efficient, forward-looking engineering analysis (including allowance for spare) suggests a cable size of 144 pairs, Hatfield assumes the next generally available cable size of 200 pairs.

[13] BCM proponents have complained that the Hatfield Model underestimates switching costs by assuming a higher DLC penetration than that reflected in the ILECs' embedded plant (and accordingly the BCM models). These claims simply ignore the central forward-looking tenet of

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Fifth, the Wire Center Module estimates costs associated with all investments in switching (including local and tandem switches along with associated investments in, *inter alia*, buildings, land[14] and power systems), signaling (including investment in Signal Transfer Points,[15] Service Control Points and signaling links), interoffice transport (including transmission systems supporting local interoffice trunking, intraLATA toll facilities and access facilities), and operator services facilities (including investments in operator systems positions and all necessary switching and trunking facilities). The principal inputs in the Wire Center Module are line count and wire center location data (Data File value and outputs from the Line Converter and Data Modules), user adjustable subscriber traffic and distribution assumptions (the default settings of which reflect Bellcore traffic engineering estimates), and switch and related facilities cost data. The Wire Center Module separately develops the wire center investment required for each switch in the modeled network (and places at least one switch per wire center), first sizing switches by applying user adjustable switch line size, switch traffic, busy-hour-call attempt and other capacity constraints to the access line totals in each wire center and then costing each switch through a two-segment linear investment curve based on per-line switching investment data obtained from a

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economic cost estimation – whatever LECs may have done in the past, the Hatfield Model employs DLC thresholds that reflect current, *forward-looking* efficient practices (and, indeed, that reflect current ILEC practices).

[14] Buildings and land price inputs can be adjusted by the user to reflect local costs.

[15] To ensure network reliability, the Hatfield Model assumes mated pairs of redundant STPs, each of which is sized so that if one of the pair is out of service, the other can easily handle all traffic.

publicly available study.[16] The model estimates supporting wire center investments from land and construction cost inputs and room size, power requirement and other functions.[17] The Wire Center Module then performs "bottoms up" transport investment calculations for common, local direct, intraLATA direct, IXC switched access direct, and special access routes that are driven by the same traffic pattern inputs and calculations used to size switches, the business/residential mix in the relevant wire center, and user-adjustable trunk-loading assumptions.[18] The Wire Center Module determines signaling link distances from existing switch and STP locations and then

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[16] Without suggesting any alternative public data-based approach, RBOC proponents of other costing models criticize Hatfield's switch costing algorithm as unrepresentative of "true" RBOC switch costs. The RBOCs have refused to provide verifiable switch cost data, however, and Hatfield has confirmed the reasonableness of its public data-based switch cost assumptions through numerous (albeit proprietary) contacts with switch vendors. And it is extremely unlikely that Hatfield's approach would underestimate RBOC switch costs, because the McGraw-Hill study from which that approach is derived relied on prices paid by ICOs, including prices paid for relatively higher-priced smaller switches. Through bulk purchases, RBOCs, however, can buy their switching capacity at averaged (and heavily discounted) per line rates that are largely independent of the sizes of particular switches. In this regard, it would be particularly inappropriate to base switch costs, as some ILECs have suggested, on anecdotal "evidence" of individual switch "prices" in a bulk contract. A vendor's primary concern is the total price it receives for the products and services it sells in a bulk contract. For this reason, the prices of individual components in such contracts often bear no relation to costs but are structured to meet the buyer's internal considerations. Further, many such contracts reflect labor costs only, with separate contracts for structure and material costs. Because the ILECs have not made public the contracts they allege support higher switching costs, there is, of course, no way to verify these claims.

[17] The Hatfield Model sizes switches to handle all narrowband traffic – intraLATA toll, access and local, both business and residential – resulting in larger switches and lower average switch cost than a network modeled solely on the residential local services at issue in the universal service context.

[18] The model directly calculates common route distances from data coordinates and provides individual user adjustable inputs for intraLATA direct and IXC access average distances. User adjustable inputs also define, *inter alia*, manhole and pole spacing, installation costs, the mix of buried, underground, optical multiplexer and patch panel costs and aerial cable and regenerator investment and spacing.

estimates signaling capacity and investment requirements based on rectilinear (as opposed to shorter airline distance) routing algorithms and user-adjustable inputs, including investment per link-mile, SS7 traffic message length and message per call attempt ratios, numbers and average lengths of ISUP and TCAP messages, and STP capacities and costs. Finally, the model estimates operator tandem and trunk requirements and operator positions support (including remote operator service positions) from operator traffic fractions, equipment prices and other factors that, again, are user adjustable.[19]

Efficient switching, interoffice transport and signaling are, of course, keys to efficient network operation, and the Commission cannot rely upon a local service costing model that ignores or shortchanges the forward-looking design, installation and maintenance of switching, signaling and interoffice facilities to yield meaningful results. In this regard, the Hatfield Model's Wire Center Module is vastly superior to the BCM (which estimates only end office switching and simply ignores tandem switching, transport, signaling and operator services), BCM2 (which provides only crude estimates of these investments) and CPM (which includes no switching cost calculations whatsoever, relying instead on a hard-wired (*i.e.*, nonadjustable) *input* for switching costs purportedly derived from another, proprietary model).

Sixth, the Convergence Module combines the loop, switching, transport, signaling and operator systems investment outputs of the previously discussed Hatfield modules. It then independently calculates and adds cost estimates for network components missing from BCM

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[19] ILEC challenges to the Hatfield Model's intentional (and proper) omission of operator wages ignore that it is *access* to operator services, and not the operator services themselves (for which ILECs can and do separately charge, as they do for directory assistance), that is a part of basic local residential service.

calculations – most notably, serving area interfaces, interfaces between feeder and distribution cables, interfaces between distribution cables and subscriber drops, subscriber drops extending to each customer's premises, and the network interface devices that mark the boundary between the customer's inside wiring and the network – as well as costs associated with installing aerial, buried and underground loop plant and associated poles, conduits and manholes. These latter "structure" costs are estimated on the basis of detailed algorithms that account for, *inter alia*, geological factors, population densities and the mix of buried, underground and aerial cable[20] as applied to the route distances of cable calculated by the Data Module.[21] The output of the Convergence Module is the total investment in the complete collection of network elements necessary to provide basic narrowband telephone services in the service area in question.

Seventh, the Expense Module performs four functions: (a) through a series of net present value calculations based on user-adjustable asset life and capital cost inputs, it converts the total investment outputs of the Convergence Module to per-month capital carrying cost figures; (b) it estimates the operating expenses associated with each category of investment;[22] (c) it estimates the variable support expenses associated with network operations; and (d) it adds retailing costs for purposes of determining universal service outputs. The module calculates a number of

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[20] Many of these inputs are density zone specific to reflect population sensitive structure cost differences.

[21] Version 2.2 Release 2 is the first Hatfield release to relate structure costs to cable sheath feet. Earlier Hatfield releases, like BCM, related structure costs to route distances. Hatfield made this modification to address questions whether cable discounts should affect structure costs.

[22] As explained in more detail below, the BCM, BCM2 and CPM models, by contrast, offer only crude analyses of operating expenses that do not analyze expenses by individual plant category and, as a result, include many expenses that are unrelated to the provision of basic local services.

individual plant-specific operating expense estimates primarily on the basis of observed relationships between operating expense and capital cost levels (reported in LEC ARMIS data) as applied to the model's forward-looking investment estimates.[23] With respect to two plant-specific expense categories – digital switching and circuit equipment – Hatfield bases expense estimates on a forward-looking New Hampshire cost study produced by NYNEX,[24] because the corresponding ARMIS data reflect embedded investments in analog equipment that is much more costly to maintain than the digital equipment that efficient LECs currently deploy and that is reflected in the Hatfield Model's capital cost estimates. The model estimates forward-looking non plant-specific operating expenses, including engineering (or "EF&I") expenses, by applying a 30% discount to reported current ARMIS cost levels to reflect both efficiency gains from competition and reductions associated with a fully digital environment. It captures forward-looking variable support expenses, such as executive, planning, and legal expenses, by increasing total costs, including operating expenses, by 10 percent.[25] Finally, the Expense Module adds retailing

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[23] The Expense Module does *not*, as some have claimed, use historical data on embedded plant-specific expenses as direct elements of its TSLRIC estimates. Rather, it develops efficient, forward-looking values for these expenses that are extrapolated from the Model's forward-looking capital cost estimates and capital cost/expense *relationships* that have existed historically.

[24] The Hatfield Model's developers and sponsors believe that these publicly available data are fully representative, and provide a good approximation, of the costs of maintaining digital switches and circuit equipment in all areas.

[25] Regression analyses performed by Hatfield and its sponsors on reported ILEC ARMIS data firmly establish the appropriateness of estimating such expenses with a "multiplier." *See* June 27, 1996 AT&T Ex Parte submission from Richard N. Clarke ("June 27 AT&T Ex Parte"). The absolute value of 10 percent reflects variable support expenses experienced by AT&T, which unlike the ILECs, is subject to vigorous competition. The corresponding average ILEC figure of 13 percent can be expected to fall on a forward-looking basis as competitive pressures force ILECs to weed out inefficiencies. Indeed, competitive market pressures have limited "overhead" loadings to 6 percent in other capital intensive industries.

expenses[26] and produces the total cost on a per line and per month basis for each of six density zones in each LEC serving area.[27] As even this summary description should make clear, the Hatfield Model is a powerful, flexible, tested tool that can be used by regulators to carry out all of their universal service modeling responsibilities (as well as their element pricing responsibilities) consistent with the goals of the Act.

In this respect, the Hatfield Model, far more so than any of the competing models, follows the basic economic costing principles that the Commission has determined best meet the Act's cost-based pricing mandate and primary local competition goal. Although no model can achieve absolute TELRIC or TSLRIC "purity," the Hatfield Model, alone among the models presented to the Commission, was designed and structured to comply to the extent practicable with all of the defining economic cost characteristics the Commission identified in its recent order in Docket No. 96-98. The Hatfield Model accordingly provides reasonable, forward-looking, geographically deaveraged estimates of all of the long-run incremental costs associated with installing, maintaining, and operating (and retailing) a local exchange network designed and sized to reflect all basic local uses and requirements.

Criticisms of the Hatfield Model largely reflect misconceptions about the operation of the model or the goals of network cost modeling (or both). ILECs complain, for example, that the Hatfield Model creates a "fantasy" network that ignores embedded ILEC technology and design in favor of engineering assumptions. It is certainly true that the Hatfield Model does not blindly

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[26] For purposes of its unbundled network element cost outputs, Version 2.2 Release 2 of the Hatfield Model includes estimates of carrier-to-carrier customer service costs.

[27] Based on user adjustable affordable rate inputs the Expense Module can then calculate universal service subsidies as a function of the number of households.

accept embedded ILEC technology and design decisions. Nor could it do so consistent with forward-looking economic costing principles. It is *not* true, however, that the Hatfield Model reflects "fantasy" technology and design decisions. To the contrary, in simulating the construction of an efficient network that would be built in a competitive environment, the model incorporates realistic assumptions concerning present abilities to adopt and implement efficient, cost-minimizing production techniques. *See Section 251 Order* ¶ 681 ("the record demonstrates that [engineering] approaches are practical and implementable"). In the vast majority of cases, the Hatfield technology assumptions reflect the *same* technologies (*e.g.*, copper loop plant, digital switches) that ILECs employ today (and have employed in the past). Hatfield expressly does not adopt newer technologies such as hybrid fiber/coaxial cable that are generally targeted at broadband offerings and are unnecessary for efficient production of basic narrowband services.[28] And contrary to the ILECs' "blank slate" cries, the Hatfield Model uses *actual* minutes of use and access line numbers reported by the ILECs and models the network from *existing* ILEC wire center and STP locations. *See Section 251 Order* ¶ 685 (cost studies "shall be based on costs that assume that wire centers will be placed at the incumbent LEC's current wire centers locations, but that the reconstructed local network will employ the most efficient technology").

Claims that the network implied by the Hatfield design approach would not "look" or "feel" like a "real" network, because it does not account, for example, for the actual locations of rivers, highways and buildings, are similarly misplaced. The Hatfield Model is designed to measure loop, switching, interoffice and related facilities requirements and *costs*, and it does a

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[28] Broadband costs (whether to provide today's frame relay and packet switched services or tomorrow's video and multimedia services) should be borne by charges to consumers of those services, not by charges to basic narrowband telephone consumers.

very good job of measuring the *amounts* of facilities required and the *costs* of placing, maintaining, and operating them – *i.e.*, the relevant economic costs of providing basic telephone services. Neither the Hatfield Model nor any of the other models submitted to the Commission are planning engineering models designed to produce network "schematics," and such capabilities, even if feasible, would in no way aid the Joint Board in carrying out its universal service responsibilities.

ILECs have also, largely through inappropriate use of undefined terms like "shared" costs, "overheads" and "joint and common" costs, suggested that the Hatfield Model fails to account for significant costs of providing basic residential service. To the contrary, the local service cost estimates the Hatfield Model produces reflect *all* of the *forward-looking* costs of installing, maintaining and operating all facilities necessary to supply basic residential service – including facilities and costs that are shared among individual network elements and services and that a pure TELRIC estimate of any one network element would not capture. Hatfield universal service outputs also reflect all of the forward-looking costs of retailing basic services *and* a reasonable share of forward-looking joint and common costs, *see Section 251 Order* ¶¶ 682, 695. The model addresses "shared" costs – *e.g.*, costs associated with conduit that carries both loop and interoffice cables -- by costing out the entire network and reflecting those costs, *not* merely the sum of individual network element TELRIC estimates, in the model's universal service and network element outputs.[29] *See Section 251 Order* ¶ 682. It addresses what some have termed "joint and common" costs – *e.g.*, legal, accounting, executive, financial and personnel salaries and

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[29] Indeed, in preparing Version 2.2 Release 2, Hatfield engineers discovered (and corrected) model estimation features that had resulted in double-counting of certain conduit and other facilities shared among network elements.

support – through its variable support factor, which grosses up *all* estimated costs by an additional 10 percent, thereby recognizing literally billions of dollars of forward-looking "overhead" associated with these functions. These billions (which reflect costs that vary with firm size and thus are properly included because they could be avoided if the firm downsized by exiting the basic services business) represent a reasonable share of such forward-looking joint and common costs, particularly since regression analyses indicate that few costs are truly "fixed" (and thus properly excluded from an incremental cost study).[30] LECs' contrary claims reflect either a failure to comprehend the model or efforts to equate joint and common costs with the "residual" or embedded costs that have no place in economic costing. *See Section 251 Order* ¶ 705 ("we therefore decline to adopt embedded costs as the appropriate basis of setting prices").

ILECs have also criticized a few of Hatfield's many inputs. As an initial matter, all significant Hatfield inputs are user adjustable, and thus ILEC criticisms of Hatfield's *default* input values do nothing to undermine the clear superiority of the Hatfield Model to the inflexible and inaccurate alternatives proposed by ILECs. Further, the model uses many of the default values criticized by the ILECs out of necessity because the ILECs have refused to provide more accurate data that only they possess (*e.g.*, business line counts on a CBG basis). Once that information becomes available – and, indeed, once any verifiable data that is more accurate than

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[30] In this regard, legal and accounting staffs can be reduced and excess office space can be released or subleased, for example, if a firm downsizes, and even the president's salary generally is largely tied to the size of the business. Indeed, regression analyses conducted on ILEC ARMIS data indicate that the portions of these overheads that do not vary with firm size are so small as to be insignificant. *See* June 27 AT&T Ex Parte. As a result, although the Hatfield Model was not designed to measure the stand-alone costs of providing basic local telephone service, and therefore does not attempt systematically to quantify all costs that are truly "joint" or "common" among a diversified ILEC's business segments, the Hatfield Model outputs may well approach stand-alone costs.

current default values becomes available – Hatfield and its sponsors would gladly provide that information to the Joint Board for use in the Hatfield Model. *See Id.* ¶ 680 ("Given this asymmetric access to cost data, we find that incumbent LECs must prove to the state commission the nature and magnitude of any forward-looking cost that it seeks to recover").

In any event, the ILECs' criticisms of particular input values are meritless. ILECs have claimed, for example, that Hatfield's reliance on average depreciation lives and capital costs reflected in ILEC filings and Commission and state commission orders is inappropriate because those figures do not properly reflect changing technologies or competitive conditions. First, the Hatfield Release 1 asset life inputs upon which the ILECs have focused their challenges are *composite* figures – *e.g.*, switching asset life assumptions include not only the switch itself, but also buildings, wiring and other significant components of switching costs that have much longer economic lives. To avoid any further confusion in this area, Release 2 has separated these composite asset lives into, for example, separate shorter asset life assumptions for switches than for the buildings that house those switches. Second, ILEC claims that rapid technological changes will shorten asset lives are greatly exaggerated – the Hatfield Model costs *basic* local services, and the technology to provide those services (*e.g.*, copper loop cable) has *not* experienced rapid technological obsolescence. Finally, significant competitive pressures will occur (at least initially) only at the retail level; ILECs will continue to have near monopolies in the provision of facilities-based local telecommunications services (to their own retail arms and to competing retailers) and thus the competitive risk of underutilization of those facilities is, in fact, slight, especially if LEC facilities are competitively priced. Indeed, increased demand resulting from the retail efficiencies and service enhancements that retail competition will generate may well offset any market share losses even after new facilities-based providers make significant inroads in the ILECs' entrenched monopolies. For these reasons, the FCC-approved current asset life and

capital cost assumptions that are the Hatfield Model defaults – and which by definition reflect judgments about future conditions -- provide reasonable forward-looking estimates. The same is true of other Hatfield default inputs; indeed, as the Washington State Commission found, the Hatfield Model's conservative assumptions are more likely to yield overstated than understated local service cost estimates.[31]

ILEC challenges to the model's logic and algorithms are also misplaced. The foregoing discussion of the Hatfield Model's structure and operation addresses many of these flawed claims. Some ILECs also question, for example, Hatfield's reliance on current demand data in sizing facilities, arguing that the network created by the Hatfield Model would be inadequate to handle future demand. Again, the ILECs ignore that the relevant goal is to produce reasonable estimates of economic *costs* of providing basic local services. The Hatfield Model does that by estimating *per line* costs that are reasonable across the range of foreseeable demand. In taking this approach, the model avoids the problem of demand forecast manipulations that have plagued ILEC cost estimates in other contexts. Further, the Hatfield Model does expressly account for short-term growth requirements, and given economies of scale changing the model to expressly recognize all foreseeable long-term growth likely would *decrease*, not increase, per line cost estimates.

Finally, a chorus of ILECs protest the cost *results* the Hatfield Model generates. The mere fact that those results differ significantly from their fully distributed embedded costs, these ILECs claim, demonstrates that the model is flawed. It is precisely that sort of "logic" that

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[31] *See Washington Util. and Transp. Comm'n v. US West Communications, Inc.*, Dkt. No. UT-950200, slip. op. at 90, 132, 134-35 (Wash. UTC April 11, 1996).

underscores the ILECs' deviation from the relevant regulatory goal of establishing subsidies that are adequate to meet the Act's universal service objectives while providing appropriate incentives on a forward-looking basis (and that infects the costing models the ILECs advocate).[32] Because Hatfield is a forward-looking model, there is no reason to expect Hatfield results to equal or in any way relate to embedded costs. As AT&T and others have explained elsewhere, there are any number of reasons for differences, including inefficiencies, overearnings and investments in facilities designed to supply enhanced services. *See Section 251 Order* ¶ 698 ("we note that the sum of the direct costs and the forward-looking common costs of all elements will likely differ from the incumbent LEC's historical, fully distributed costs"). Whatever the explanation, however, such "shortfalls" provide no justification for increasing universal service subsidies and the Commission should reject any model that attempts to capture them.

In sum, the Hatfield Model adheres to economic costing principles, measures the appropriate costs of supplying basic residential services, and has ample flexibility to address all relevant universal service costing issues.

II. BENCHMARK COST MODELS

Like the Hatfield Model, the Benchmark Cost (or "BCM") models advanced by certain ILECs employ a "scorched node" approach to network design, taking the locations of existing wire centers as given. And, like the Hatfield Model, the BCM Models are "bottoms up"

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[32] A recent report by an analyst at the financial firm of Janney Montgomery Scott illustrates the dangers of relying on crude and misguided "results" comparisons to draw any conclusions about a costing model's reliability. In that report, the analyst criticized the Hatfield Model's expense estimation capabilities on the basis of a comparison of an estimate of long distance industry expenses with Hatfield "results" derived from her own (wildly erroneous) claim that Hatfield Model calculate local expenses at only $4 billion (less than half of her long distance estimate). In fact, the Hatfield Model produces expense estimates of nearly three times that amount (significantly *more* than the long distance estimate).

engineering models that "construct" a network based on those wire center locations from the ground up. As explained below, however, these similarities are overwhelmed by significant differences that render the BCM models inappropriate for use in modeling the forward-looking costs at issue here.

A. Original BCM

As its own sponsors have recognized, the original BCM model, an early effort by US West, NYNEX, MCI and Sprint to estimate urban/rural cost differences, is not, standing alone and without further adjustment, a sufficiently flexible and reliable tool for estimating the economic costs associated with supplying basic residential telephone services. *See* Benchmark Cost Model: A Joint Submission by Sprint Corporation and US WEST, Inc., CC Docket No. 96-45 at 2 and n.3 (July 3, 1996) ("the original BCM was not designed to develop the cost of basic telephone service"). Among other limitations, the original BCM Model, or "BCM1," actually estimates only loop and switching capital costs; it contains no algorithms for the calculation of other facilities necessary to provide basic telephony services, *e.g.*, interoffice facilities), and none for the calculation of efficient forward-looking operating expenses. Rather, some BCM1 supporters have suggested that the Commission estimate these other costs through crude "add-ons" based primarily on ILECs' embedded costs. With respect to operating expenses, for example, several ILECs proposed a 32 percent lump sum add-on based solely on historical ILEC accounting data. This application of historical data without any category-by-category analysis plainly violates the central forward-looking tenet of economic costing.[33] This error is magnified by applying the 32 percent multiplier to a bloated capital cost base that, as explained below, overstates the costs associated with supplying basic telephony services by failing to exclude capacity and technology designed to support broadband and other enhanced services.

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[33] As noted above, category-by-category analysis is necessary to properly account, for example, for cost savings from digital technology and inefficiencies that an efficient provider subject to competitive forces would not incur.

Even with respect to the loop and switching facilities, BCM1 has serious limitations. Loop calculations omit customer drops, manholes, and network interface devices and other interface facilities (which again must be reflected by crude embedded-cost-based add-ons). And BCM1 assumes that *every* switch has a fixed cost of $647,526 and a per-line cost of $238.87 -- values that are grossly inflated and wholly unsupported. Small switches are available at prices well below $647,526; hence, a fixed cost of $647,526 before the first line is added is unsupportable.

The most basic flaw in the BCM1 Model is its undocumented and insupportable assumption that existing ILEC networks are sized efficiently to provide basic telephony services -- *i.e.*, that embedded capacity equals efficient forward-looking capacity. Thus, BCM1 uses fill factors as low as 25 percent, resulting in a modeled network capable of handling basic telephony traffic many times over. BCM supporters assert that there are "engineering" reasons for such enormous levels of "spare" capacity, notwithstanding that they have been telling their shareholders and the press for years that the ILECs developed this "spare" capacity to take advantage of perceived future opportunities in long distance, broadband and other markets.[34] An efficient

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[34] The RBOCs and other ILECs have trumpeted that growth in their networks has been driven primarily by their desire to provide broadband and advanced narrowband services, and by the explosive growth of second and third household lines. For example, Ray Smith, Chairman and CEO of Bell Atlantic, stated in remarks at the Merrill Lynch Telecom CEO Conference on March 19, 1996:

> In 1995, sales of secondary lines at Bell Atlantic increased more than 50 percent, fueled by surging demand for Internet and telecommuting applications. Unlike traditional horizontal line growth, which would have significantly added to our capital expenditures, the vertical growth we experienced in '95 brought most of the revenues down to the bottom line. That's because we were able to provision new lines and services from idle capacity in an existing plant.

BellSouth made a similar point in a press release in 1995:

> BellSouth Corp. said it expected to sustain its growth in basic telephone services fueled by continued demand for second lines, and buoyant sales of

(footnote continued on following page)