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Towards Next Generation Telco Billing 3.0

AI-native systems catalyze a billing renaissance

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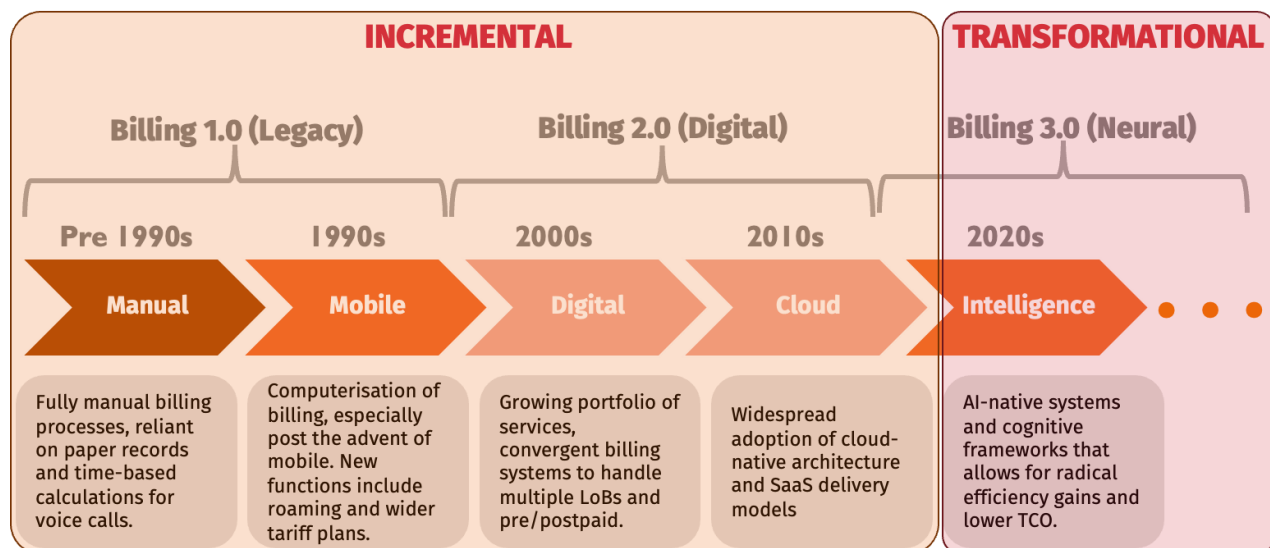
EXECUTIVE SUMMARY

Telco billing systems stand at a pivotal crossroads. Behind them lies a decades-long legacy characterized by intricate customizations, costly maintenance, and complex interfacing between disparate systems – hallmarks that have historically defined the telecom billing landscape. Ahead lies a transformative future built on unified, intelligent architectures that promise unprecedented flexibility. This stark contrast between the rigid complexity of legacy systems and the adaptable simplicity of AI-native cognitive architectures represents not just a technological evolution, but a fundamental reimagining of how telecom billing systems can operate.

CSPs invest a staggering \$18 billion annually in revenue management systems and related infrastructure. However, this massive investment has largely failed to deliver modern billing capabilities. This shortfall can be attributed to two interlinked factors: First, the majority of this spending is consumed by maintaining and patching legacy systems, leaving minimal resources for modernization initiatives. Second, until recently, billing system upgrades have been largely evolutionary rather than revolutionary, offering incremental improvements instead of the transformative changes that CSPs desperately need. These two challenges are deeply interconnected, creating a self-reinforcing cycle that impedes progress.

The heavy investment in legacy system maintenance not only drains resources but also perpetuates reliance on incremental solutions. To break free from this cycle, CSPs must make a decisive shift away from legacy systems and embrace future-proof billing platforms. The telco billing landscape has traditionally progressed at a measured pace, marked by incremental improvements rather than dramatic shifts. However, the emergence of AI heralds a revolutionary period that promises to fundamentally transform how telco billing systems operate (figure 1).

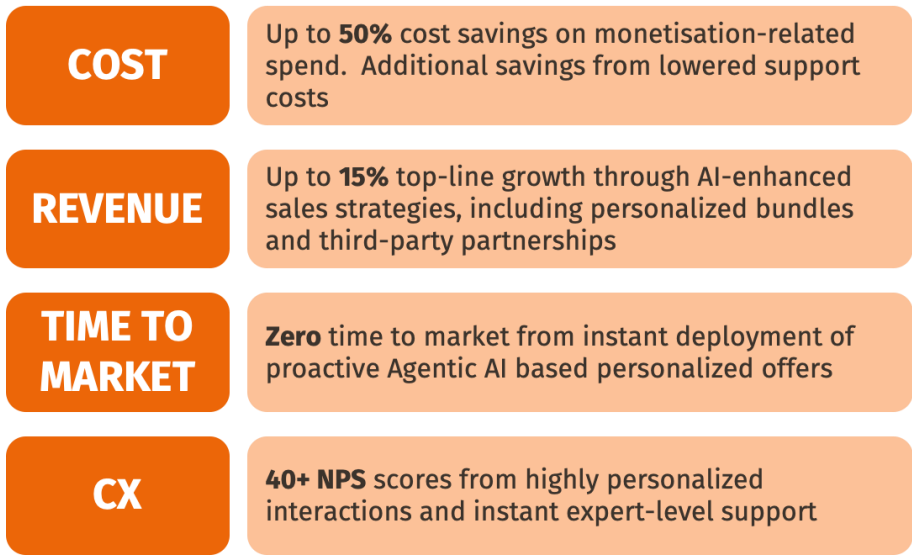
Figure 1: Overview of the evolution of telco billing function



Source: Appledore Research

A billing 3.0 system, also referred to as neural billing system, could revolutionize telecom operations, delivering unprecedented advantages in the short to medium term. The key metrics demonstrating key benefits are illustrated in Figure 2.

Figure 2: Leading benefits of deploying billing 3.0 systems in telco



Source: Appledore Research

The adoption of a neural billing platform represents a pivotal opportunity for CSPs to achieve the long-desired modernization of their billing infrastructure. This presents telecom executives with a rare strategic opportunity to streamline their complex legacy systems, achieve significant cost reductions, and unlock substantial new revenue streams.

THE EVOLUTION OF BILLING SYSTEMS

In the past decade, CSPs have taken a deliberately cautious approach to evolving their billing systems, resulting in gradual, incremental changes. This conservative stance stems from two key factors: the critical nature of billing operations where failures cannot be tolerated, and the substantial initial investments made in these systems, which led CSPs to maximize their return by extending the systems' operational lifespans.

Telco billing systems trace their roots to the very beginning of telephone services. Initially, billing was entirely manual - operators maintained paper records and calculated long-distance charges based on call duration. The modern era of billing systems began in the 1980s with the introduction of computerized solutions in telecommunications companies.

The 1990s mobile communications boom brought renewed focus on telecom billing, as CSPs invested heavily to prevent revenue losses from inadequate billing processes and systems. During this period, there were a number of new capabilities added such as roaming and SMS, while the number of tariff plans also increased, all of which added to the complexity of billing operations.

The emergence of digital services in the 2000s catalyzed a fundamental shift toward unified billing platforms capable of managing diverse service portfolios and pre/postpaid. This period saw a dramatic proliferation of products and offerings, along with new systems requiring billing integration. As a result, CSPs had to develop and maintain numerous customized interfaces to accommodate this growing complexity.

The cloud era brought heightened recognition of legacy architecture limitations and the imperative to transform them for improved total cost of ownership (TCO) and operational efficiency. CSPs sought to emulate digital natives' architectural approaches, making cloud-native microservices architecture a central focus. While SaaS gained momentum in billing during this period, its adoption was primarily limited to emerging use cases and specialized applications.

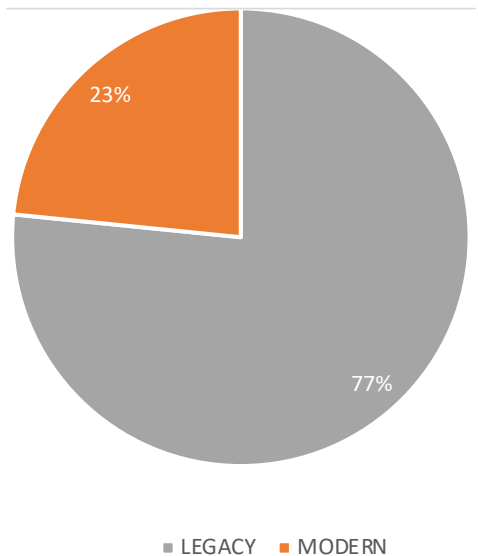
The 2020s has already witnessed a surge in intelligent capabilities across telecom operations. This era is characterized by a transition toward unified architectural platforms that incorporate unprecedented levels of intelligence and automation. The foundation of this new paradigm rests on four key pillars: technology-agnostic frameworks, dynamic scalability, intelligent self-learning systems, and extensive expandability.

Neural billing marks a transformative advancement in agility, performance, and efficiency.

THE LIABILITIES OF LEGACY BILLING

Legacy telco billing systems are notorious for their complex and antiquated architectures. This complexity stems from multiple rounds of capability additions without fundamental restructuring of underlying data models and system frameworks. The resulting landscape consists of various proprietary systems from multiple vendors - some no longer in business - interconnected through highly customized interfaces that require ongoing support from external service providers. This architectural framework carries substantial technical debt, leading to unsustainably high support and maintenance costs (figure 3). Approximately 77% of total billing system expenditure is consumed by legacy system maintenance.

Figure 3: CSP spending on legacy vs modern billing systems as a % of total billing spend



Source: Appledore Research

The table below captures the most consequential challenges of legacy billing systems.

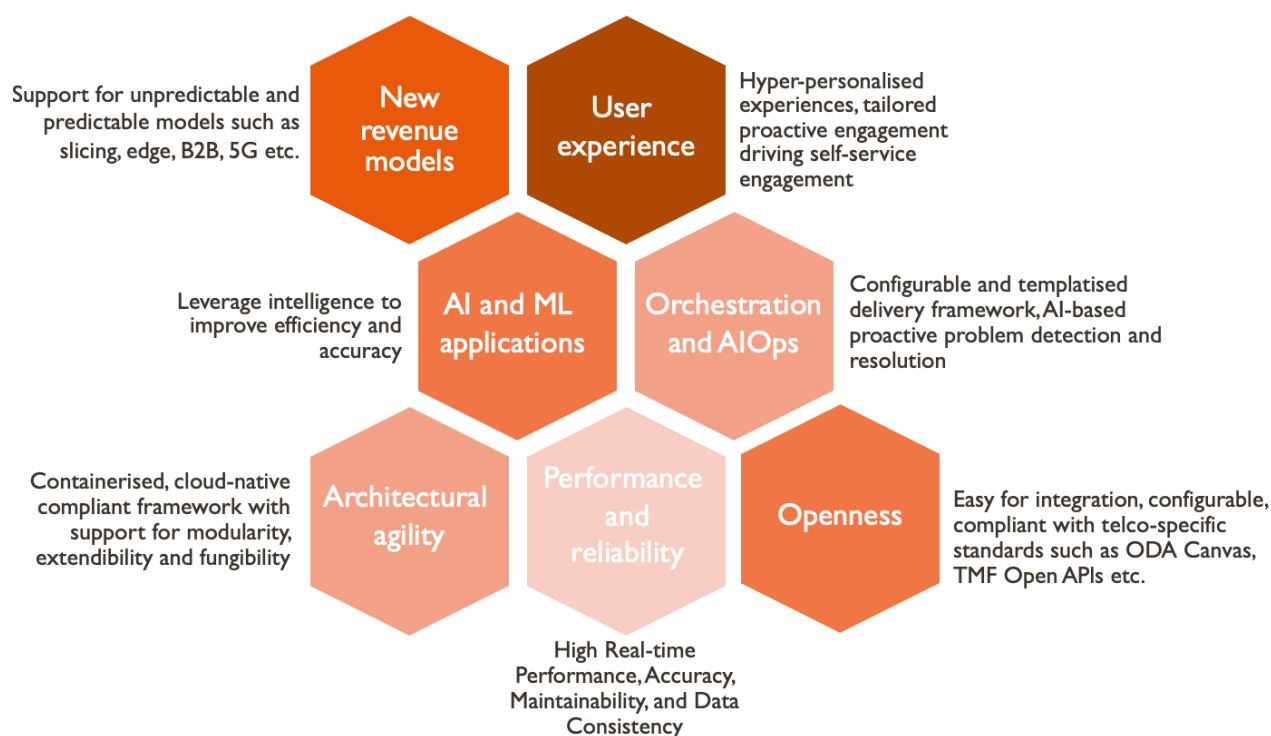
Issue	Description	Impact analysis
Lost revenue	Legacy billing systems severely limit CSP participation in opportunities due to lack of support or slow processing speeds.	Legacy billing systems reduce revenue potential by 0.4% to 3% due to their inability to support new business opportunities, depending on the nature of the incumbent system.
Monolithic products deployed within siloed architecture framework	Legacy architecture framework is disparate and relies on siloed systems with limited interconnections.	CSPs are unable to make timely introductions of new products and services and effectively monetize existing services as every change is not isolated and may involve multiple components and influence the entire ecosystem.

Issue	Description	Impact analysis
Complex multi-vendor environments	CSP environments typically have multiple – and sometimes duplicate – vendor solutions that are often highly customized.	Support and maintenance costs are disproportionately high.
Inconsistent and inflexible data models	The data models play an important role in how products and services are defined and how effectively CSPs can monetize new opportunities.	Long lead times for launching new products and services.
Widespread use of proprietary, non-standardised interfaces	Interconnections between systems play an important role in facilitating new services.	Legacy monetization systems mostly rely on proprietary API interfaces, which are expensive to set up and tend to break often. They also limit the ability to connect to third parties and promote a digital offering.
Managing the end-to-end lifecycle of monetisation systems software	Managing the life cycle of different and disparate applications – including the core, software framework and related customization – is complex and expensive.	The IT organization often gets distracted by products and applications lifecycle administrative tasks, which affects their ability to deliver business efficiency and functionality.
Limited ability to 'open up' for third-party solutions	Interoperability and support for third-party solutions is an important driver for new revenue opportunities and deeper customer engagement.	Legacy systems were not built to support extensive interoperability and often require new interfaces, making the system clunky and slow. Leading CSPs are known to invest tens of millions per integration for large partners. Absence of support for ecosystems can be detrimental to launching new services, scale and winning new customers.
Multiple billers from multiple vendors	Billers serve as the core revenue engine for telcos, processing usage data, applying charging rules, and generating customer invoices.	Due to mergers and piecemeal system additions, many telcos operate multiple billing platforms from different vendors, increasing billing errors that result in revenue leakage, increased manual interventions and degraded customer satisfaction.
Lack of cohesive intelligence	Integrating AI into telco billing systems is essential for optimizing operational efficiency.	Telcos' AI implementations in billing remain fragmented and lack comprehensive integration, resulting in suboptimal automation and decision-making outcomes.

THE KEY FACTORS OF NEXT-GENERATION BILLING

Today, we stand at the threshold of a new era defined by artificial intelligence and automation. The timing for transformation is especially favorable as CSPs now recognize the critical need to modernize their billing systems and have made this a strategic priority. Learning from past transformation attempts, CSPs now understand the importance of a phased approach. Earlier initiatives fell short due to hasty deployments that addressed isolated issues rather than systemic challenges, unrealistic schedules, and an inability to shift from operational efficiency to customer experience priorities. This shift affects not only technology decisions but also requires fundamental changes to organizational structure, decision-making processes, and operational workflows.

Figure 5: Overview of the key building blocks of billing 3.0



Source: Appledore Research

The convergence of optimal timing, telecommunications industry imperatives, and advanced technological capabilities sets the stage for a transformative leap in telco monetization through neural billing systems. Neural billing represents a complete reimagining of telecommunications billing fundamentals, creating a future-ready framework (figure 5).

While most telecom systems have modernized over time, billing has remained largely unchanged. This slow evolution is understandable given billing's critical importance to business operations and the challenges of working with multiple generations of technology from different vendors. The transition to next-generation billing systems represents a fundamental shift from traditional approaches.

Key contrasts between legacy billing and neural billing systems are captured in the table below.

Function	Billing 1.0/2.0	Billing 3.0
Bill delivery	Bills are delivered through outdated methods – primarily paper statements sent by mail or basic PDF attachments in email.	- Realtime billing through mobile app - Interactive digital statements - Bills via SMS/ messaging apps - Bill summary delivered via external channels (like Alexa) through APIs
Bill presentment	All customers receive the same standardized bill format, with no ability to customize how information is displayed or organized. The bills lack personalized features like preferred layout, custom spending categories, or tailored usage insights.	- Hyper-personalized bill formats with tailored usage insights. - AI generated summary of key charges, month-on-month changes etc. providing a zero-confusion experience. - Also provides real-time usage tracking and billing information
Customer portal	Legacy billing systems typically lack modern customer self-service portals. When online access is available, customers can usually only view basic, non-interactive bill statements.	Human-like interactions through AI agents, access to comprehensive and accurate information through natural language, real-time spending controls, analytics, recommendations and plan optimization, payment scheduling etc.
Bill run and Invoicing	Archaic manual intensive bill run process causing delays in invoice generation. Invoices generated using data that's several weeks old. Discounts can only be applied using inflexible, pre-set templates. The process of matching payments to invoices must be done as a separate operation, rather than in real-time. This creates delays in payment processing and makes it harder to offer timely, personalized discounts.	- Automated bill-run with error handling - Real-time invoice generation and delivery - Dynamic pricing and personalized discounts - Automated revenue recognition, invoice reconciliation
Pricing models	Rigid pricing systems that are costly and time-consuming to modify, since they require custom coding. The pricing options are mostly confined to basic prepaid and postpaid models - charging based on usage volume, time duration, or number of items used. Can only offer a small selection of pre-configured service bundles, with little room for customization or creating new package types.	- Configurable and highly flexible with a broad set of capabilities. - Ability to charge by tiers, volume, count, other attributes, supports trials, prepaid credits, overages etc. to incentive customer behavior. - Also support separate pricing for subscriptions, setup, usage, one-time purchases OTP-based purchases, custom services etc.

Function	Billing 1.0/2.0	Billing 3.0
		• Able to support convergent business models with multiple dimensions and multi-step value chains including B2B, B2C or both.
Dunning	Too many manual interventions required. Limited to payment reminders with fixed grace periods. Service restrictions implemented based on a fixed model for all users.	• Automated multi-channel reminders, AI-based prediction of payment likelihood, dynamic payment plans based on customer history, automated credit scoring and risk assessment, real-time suspension/resumption of services

The impact of neural billing will fundamentally change the telecommunications billing landscape. Unlike previous incremental improvements, this represents the first truly revolutionary advancement in the field. Billing 3.0 marks the beginning of an autonomous telecommunications billing ecosystem that operates seamlessly behind the scenes, eliminating the need for constant supervision and coordination across multiple departments.

From an operational standpoint, this represents a milestone achievement, delivering unprecedented accuracy, streamlined processes, and enhanced autonomous capabilities for delivery, deployment, and upgrades. From a business perspective, this will enable intelligent systems that rapidly capitalize on emerging opportunities and integrate into new value chains. Additionally, it will significantly reduce the supervision requirements from both business and operations teams. And from a financial perspective, this will generate substantial cost savings through minimized support requirements, decreased staffing needs, and lower opportunity costs.

CONCLUSION

The stark contrast between legacy and neural billing systems represents more than just a technological upgrade - it's a fundamental shift in how CSPs engage with their customers, expand into new domains and compete effectively in an evolving market.

CSPs need to modernize their billing systems now to remain competitive. Today's customers demand personalized experiences, adaptable payment terms, and smooth digital engagement - making the transformation of outdated billing systems an urgent priority. These legacy systems have become a serious business liability that holds providers back from meeting evolving customer expectations. Additionally, the cost and complexity of maintaining aging billing systems continues to mount, while the opportunity cost of delayed modernization grows even faster.

The transition to neural billing systems is not just about technological advancement - it's about future-proofing operations and enabling business transformation.

Appledore Research's key recommendations for telco billing transformations are as follows:

1. **CSPs should prepare for future-ready billing platforms by embracing neural billing principles.** Quick-fix billing solutions that prioritize immediate cost savings over long-term sustainability create technical complexity, increase total cost of ownership, limit system adaptability, and result in missed revenue opportunities. CSPs who delay transformation risk falling further behind while incurring increasing technical debt.
2. **CSPs should pursue a unified, pre-integrated end-to-end solution when modernizing legacy billing systems.** Partnering with a full-stack billing vendor gives CSPs flexibility in their transformation journey. This approach gives CSPs flexibility to either transform individual components incrementally while maintaining oversight (suitable for mid/large CSPs) or implement a complete billing system replacement (ideal for small telcos or greenfield B2B operations).
3. **CSPs should seek vendors who excel in both comprehensive, pre-integrated solutions and legacy system integration.** This approach delivers three essential benefits: flexibility in choosing where to begin modernization efforts, a cohesive architectural framework, and seamless integration with existing systems. The vendor should have leading telco technology, rich transforming experience and reliable local service & delivery team, a right partner means a half of success. By choosing such vendors, CSPs can modernize their infrastructure at a pace that aligns with their business strategy and market requirements, while maintaining critical legacy functions.

As the telecoms industry continues to evolve, the gap between operators with legacy systems and those with billing 3.0/neural billing capabilities will only widen. Those who hesitate risk falling behind in customer satisfaction, operational efficiency, and market adaptability.

ABOUT THE AUTHOR



With over 18 years' experience in the telecom industry, **John Abraham** leads Appledore's Digital Enablement program. Previously he was at Analysys Mason for 11 years where, as Principal Analyst, he led the Digital Experience research segment. He has experience working with a varied client base on topics ranging from digitisation benchmarking and procurement for CSPs; strategy and go-to market for vendors and commercial and technical due diligence for financial institutions.

Earlier as a consultant at a BSS vendor, he led implementation of BSS projects at multiple tier-1 telcos in Asia and Europe. John holds a bachelor's degree in computer science from Anna University (India) and an MBA from Bradford University School of Management (UK).

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