BRISTOL, Conn.—In the control room of ESPN's headquarters, a row of screens shows video feeds going out to cable providers for each of its television channels. But a growing part of ESPN's future lies across the room, where a similar setup tracks transmissions to the Internet.

On a recent Saturday, technicians were busy streaming several dozen games, some at the same time as they were on television and others that weren't televised at all. Damon Phillips, in charge of the service, used a tablet computer to monitor how many people were watching online.

"I'm obsessed with this," he said, pointing to the usage tally, which he starts checking at 5:30 a.m. while on his exercise bike. "I look at it all day long."

The app, called WatchESPN, is part of an aggressive push by ESPN into online services as pay television matures. ESPN pioneered sports TV on that medium and for three decades rode a steady rise in U.S. cable and satellite TV subscriptions. These now have leveled off and appear to be contracting. ESPN is at the forefront of the TV industry's efforts to expand into Internet distribution.

The company, which generates about 40% of majority owner Walt Disney Co.'s operating profits, sees the app as a way to cash in on growing demand for online video. But with its TV offerings still lucrative, ESPN is walking a fine line, trying to avoid doing anything that might encourage customers to drop their pay-TV subscriptions.

It is a challenge others in the business also are wrestling with. ESPN's strategy is to allow only pay-television subscribers to stream games that air on ESPN TV channels.

The sports network has devised a complex business model. Although the app is delivered over the Internet, ESPN collects money for the app from pay-TV providers such as cable companies, which pay for the right to offer it to their customers. For ESPN, a second revenue stream comes from advertising on the app.

The WatchESPN app also includes a strictly online channel, called ESPN 3, that shows lower-profile sports such as rugby, polo and small-college athletics. For that, in most markets, users don't need to be pay-TV subscribers.

The dual strategy results from years of experimentation and debate inside ESPN, and in the industry more broadly, over how to deal with the saturation of the pay-TV industry and thirst for online video. Time Warner Inc. TWX -0.31% 's HBO, for instance, has said it might offer a version of its HBO Go app to Internet users for a subscription fee, depending how the pay-TV industry evolves, though for now HBO plans to continue limiting access to subscribers who pay for the premium channel.

Most network owners, including ESPN, say the risk of cannibalizing their pay-TV businesses is too great to offer stand-alone online subscription services. It isn't clear they could charge enough to be as profitable as deals with pay-TV providers. Revenue from mobile advertising, while growing, isn't nearly enough to replace TV ad dollars. Media companies also would have to take on customer-service responsibilities now handled for them by cable and satellite companies.

Yet content providers face the reality of weakening pay-TV subscriptions. ESPN lost roughly 1.5 million subscribers between September 2011 and September 2013, according to Nielsen data provided by the company. Part was from dropped pay-TV subscriptions and part from downgrades to lower-cost packages not including ESPN. The company says the changes haven't affected its TV ratings materially.

ESPN President John Skipper calls the losses "marginal," given that the sports network reaches into 98.4 million households. Still, he doesn't dismiss the threat.

"Pressure on the system provides peril for ESPN," Mr. Skipper said in an interview. "But ESPN, as long as the system doesn't break up, is in fine position." He said WatchESPN makes pay-TV subscriptions more valuable.

Several hurdles lie in ESPN's online path. Professional sports leagues, which already collect huge sums for TV rights, see an opportunity in the next decade from selling their digital rights or offering games via their own streaming-video services. For ESPN, acquiring streaming rights is complicated and becoming more costly.

Pay-TV providers such as cable companies, for their part, are likely to push back as ESPN, which is already the most expensive cable-TV network, raises its prices to offer WatchESPN.

Limiting the online viewing of TV channels to pay-TV subscribers, a strategy also pursued by most other TV-channel owners, carries risks. Besides excluding customers who have "cut the cord," it excludes "cord nevers": sports fans, mostly younger, who have never subscribed to a cable or satellite service.

And if operators such as cable companies pass on to subscribers the fees ESPN charges them, the higher cost could prompt more to disconnect. Some pay-TV executives say rising prices are a major reason customers bow out.

Mr. Skipper, a 58-year-old former Spin magazine executive who took the helm of ESPN in 2012, acknowledged a "dissonance" between its instinct to disseminate its content as widely as possible and the usage restrictions designed to safeguard the core television business. "There's no denying there's a certain element of protection and defense," he said.

Though the company has internally considered a stand-alone broadband offering, "it's not close yet."

As for what ESPN's endgame is, Mr. Skipper said the company plans a lot of online experimentation, but its priority is to protect pay-TV profits: "Our calculation right now is we're going to ride this. We're going to ride it as long as it makes sense."

ESPN still has growth opportunities in TV, Mr. Skipper added, including a new college sports network it is launching this year with the Southeastern Conference and expansion in Latin America.

ESPN first tried online distribution in the early 2000s, well before most other networks. Leading the effort was Sean Bratches, who dealt with cable and satellite companies. Known for his vast cuff link collection and coordinated ties and pocket handkerchiefs, Mr. Bratches cut an unlikely figure for a technology innovator.

He came up with an unorthodox initial business model for ESPN: It would charge the providers of high-speed Internet service a per-subscriber fee to make sports available online to their customers.

The idea faced opposition internally from executives who wanted a more traditional Web approach of giving away content while making money on ads. Mr. Bratches argued that ESPN could extend to the Internet its cable model of earning money from both ads and subscriptions. He prevailed, and in 2001 ESPN launched its first broadband service.

It struggled to gain traction. Some Internet-service providers balked, not used to paying for content. ESPN executives blamed the rough start also on their website's clunky design and lack of live events. To lift usage, they started putting online some games airing on their flagship TV channel.

But by 2010, when ESPN began a round of contract renewals with pay-TV distributors such as cable companies, the industry's subscriber growth had slowed sharply. Both sides worried that making TV content available online could encourage more pay-

TV subscribers to disconnect. In negotiations with Time Warner Cable, TWC -1.42% ESPN hashed out a deal to combat that with the limit on online access.

The result was the WatchESPN app. Its simple design, which grew out of a paper sketch by Mr. Skipper, allowed tablet and smartphone users to tap on-screen boxes to play ESPN channels. It launched on mobile devices in April 2011.

The earlier broadband service, by then named ESPN 3, could be accessed through the new app, but phased out televised games. It has charted a new course as a place for thousands of events that the company has the rights to but that don't make it to TV, such as cricket and collegiate gymnastics. ESPN has enlisted some colleges to handle production of their own events, to expand offerings while keeping costs down.

Though ESPN 3 can be accessed without a pay-TV subscription in most markets, the company is careful not to market it as a product for cord cutters.

"We want to be conscientious that we don't overplay our hand," Mr. Bratches said in an interview at his New York office, stuffed with all manner of sports paraphernalia: books on Jerry West and Muhammad Ali, football helmets, a bowling pin, a punching bag and baseball bats.

The WatchESPN app has been downloaded 25 million times. Its viewership remains far below television's. Some 26 million people watched college football's national championship game Jan. 6 on television, but just 773,000 saw it online with WatchESPN.

Still, as ESPN has renewed deals with cable and satellite operators, it has cited the app as a justification for rate increases. Its flagship channel is already by far TV's costliest, at $5.54 a month, according to market researcher SNL Kagan.

Access to the app raises the price. Time Warner Cable and Verizon Communications Inc. VZ +0.08% 's FiOS service, which offer the app to their subscribers, pay ESPN 19 cents more per subscriber each month than does Dish Network Corp. DISH -0.62% , which doesn't support the app, according to papers from a court case involving ESPN and Dish last year. Dish is currently in negotiations with ESPN for a contract renewal.

DirecTV has balked so far at ESPN's asking price for streaming video access, said a person familiar with the matter. However it is likely to negotiate for those rights when its contract with ESPN expires at the end of this year.

At ESPN, the broadband push has meant a cultural shift for a TV-centric company.

Getting software engineers to move to ESPN offices in the sleepy Connecticut town of Bristol wasn't easy. A key hire last year was Ryan Spoon, an eBay Inc. alum and former venture capitalist, who has hired veterans of major Silicon Valley companies.

Now a team of ESPN engineers is developing algorithms to link online programming options to users' tastes and affinity for certain teams, sports or cities. ESPN executives have taken product advice from the likes of Apple Inc. AAPL +2.06% Chief Executive Tim Cook, a fan of the Auburn Tigers, and Google Inc. GOOG -0.42% Chief Business Officer Nikesh Arora, a fan of cricket.

In ESPN's control room, balloons on an overhead screen track how heavily WatchESPN is being used around the country, while analysts monitor bandwidth usage to make sure the video streams don't hiccup en route to users.

Getting streaming rights can be problematic. ESPN has had the right to televise Monday Night Football since 2006 and struck a deal with the National Football League in 2010 that allowed streaming of the game to desktop, laptop and tablet computers. Yet ESPN can't stream it to smartphones.

Mobile-phone rights to the Monday game weren't on the table when ESPN last renewed its deal with the NFL. Verizon owns the streaming rights to Monday night, Sunday night and Thursday night NFL games, and has just agreed to a four-year contract extension that will also allow people to watch Sunday afternoon home-market games on mobile phones.

ESPN keeps having to pay leagues more. In the contract it negotiated with the NFL in 2011, the network agreed to pay an average of $1.9 billion a year, up 58% from before. And last year, ESPN and Major League Baseball reached an eight-year deal that, at $700 million a year, was double the earlier price. Streaming rights were a factor in the increase, said a person familiar with the matter.

ESPN is working on perfecting sales of ads for the app. It says it sold app ads to some 200 brands in 2013. But these haven't been enough to fill every available ad break.

Partly that is because the technology to serve up ads into the app isn't yet very advanced and can't always find spots of the proper length to insert. When TV viewers see commercials, app users are sometimes shown filler material.

ESPN is talking to broadband providers about other Internet products, such as an ultra-high-definition version of its TV channels that would be offered only to people who upgrade to faster tiers of broadband.

"We innovate with the consumer in mind and with the philosophical default that we are going to adopt new things," Mr. Skipper said. "We are not going to resist."

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Corrections & Amplifications: ESPN President John Skipper is 58 years old. A previous version of this article incorrectly said he was 59.