CUBIC. | Transportation Systems

NextCity Brief

What is NextCity?

# WHAT IS NEXTCITY?

NextCity is Cubic Transportation Systems' vision—for city management and integrated traveler payment and information that centers on three core principles: the delivery of an integrated customer experience, one account and integrated operations and analytics. This vision for tomorrow is how the cities of the world can respond to the increased pressure that population growth and urbanization are putting on their transportation infrastructures.

Cities are growing – and fast. By 2050, it's predicted that 75 percent of the world's population will be urban dwellers: There will be more cities – and much bigger ones. Cubic research summarizes that there will be one European "megacity" (London), three in Africa (Kinshasa, Lagos and Cairo) and five in the Americas (New York, Los Angeles, Sao Paulo, Mexico City and Buenos Aires). Of these, three have Cubic systems today for ticketing and related ITS on their public transportation networks (London, New York and Los Angeles). In Asia, there are eleven megacities including Tokyo, Mumbai, Shanghai, Beijing, Delhi, Kolkata and Dhaka. These last seven hold the top seven slots worldwide. Collectively, all this growth means there will be increased demand on the existing infrastructure, which is close to capacity.

To function, these cities each depend on mobility across all modes including public transit, private vehicles on toll roads, highways and bridges, car and bicycle share, taxis, etc. People must get from home to work efficiently, and urban transportation in all its forms is critical to ensuring this happens. However, there are severe restrictions prohibiting many of the possible solutions that could otherwise accommodate this growth.

> AS THE LEADING INTEGRATOR OF PAYMENT AND INFORMATION TECHNOLOGY AND SERVICES FOR INTELLIGENT TRAVEL SOLUTIONS WORLDWIDE, CUBIC HAS A BROAD UNDERSTANDING OF THE CHALLENGES FACING CITIES AND THEIR TRANSPORTATION INFRASTRUCTURES.

In many cities, especially in the developed world, it is not physically possible to enlarge stations, platforms or toll plazas. Public transit timetables are already at saturation point. River crossings including toll crossings are at capacity without the flexibility to allow the running of additional trains or cars. Worldwide, public leaders must manage infrastructure more efficiently to accommodate growth. This need is further challenged by growing environmental pressures to reduce our carbon footprint and the speed of global warming. Further, the infrastructure and all the modes that use it – rail and road -- require adequate funding. This will place enormous pressure on the urban transportation system; both government-run and privatized, to find ways to solve these problems.

At the same time, other megatrends in consumer behavior and technology advances create opportunities to help address these problems with an integrated traveler payment and information system.

- **The mobile and wireless revolution** means people and devices—the Internet of Things—are always connected and "always on," making it feasible to understand real-time performance of combined modes of urban transportation facilities and update people through their mobile devices in real-time with information that can change travel behavior.

- **As "big data" comes to transportation**, planners can now combine volumes of transportation fare and vehicle information with even larger sets of information from other sources and apply a new generation of analytics and visualization tools to get insights into what the massive amounts of information is telling them. With this knowledge agencies and authorities will actually be able to predict what is likely to happen under different scenarios, making them far more effective at restructuring their transportation networks than they are today.

- **Cloud computing and advances in business software** have created off-the-shelf, enterprise best-of-class systems, already used by thousands of blue chip companies in comparable industries like financial services and logistics, for the transportation sector. This means core business and customer service systems no longer need to be expensive custom developments, and systems can be shared across multiple organizations to improve services, reduce costs and extend the scope of managerial insight across cities or even regions.

As the leading integrator of payment and information technology and services for intelligent travel solutions worldwide, Cubic has a broad understanding of the challenges facing cities and their transportation infrastructures. Cubic processes 24 billion transportation transactions a year collecting $18 billion for its public clients. In this brief, we will look at how Cubic's NextCity vision can address these challenges.
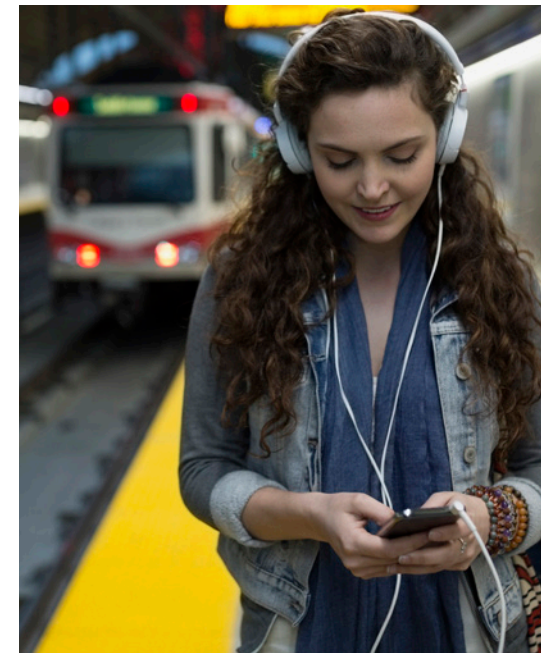
## CHALLENGE
Systems are under-integrated and custom built

## VISION
Shared citywide or regional systems that support separate business rules and leverage off-the-shelf technology

CUBIC, IN BUILDING A MODERN IT SOLUTION, INTEGRATES THE BEST AND WIDELY USED THIRD-PARTY APPLICATIONS TO PRODUCE A FLEXIBLE BUT EXTREMELY SECURE SOLUTION. SIMPLY STATED, IT IS THE FUTURE OF TRANSPORTATION PAYMENT.

Urban transportation systems are under-integrated, serving multiple public and private operators and generally unable to offer intermodal solutions. This flows from the multiple jurisdictions with responsibility. Rarely are toll roads, transportation systems and parking operations, or even any two systems, managed by the same agency. Their individual goals are both policy and financially driven, and they are responsive to different and unrelated leadership.

A related problem is that in the history of highway, transportation and tolling technology, the focus has been on the front end. Attention has always been on detection, toll tags or transportation tokens or payment media. This focus has led to back office and payment systems being an afterthought, typically hard-coded legacy systems built from the point of sale back.

### PROPRIETARY EQUALS UNPROGRESSIVE
Changes are expensive and time consuming due to the proprietary nature of the systems.

In accounting for its revenues, the industry sees increased costs and, in many cases, actual losses from fraud and reconciliation difficulties in closing the books. The proprietary system architectures make it difficult to alter pricing and other business rules and to keep pace with industry security requirements like PCI, PA DSS and EMV.

These factors severely constrain the capability for managers to optimize the travel experience of citizens and visitors and balance usage of its infrastructure network regardless of mode. Operations and customer service systems struggle to keep pace with advances in Web self-service and mobile, and run up costs by requiring expensive upgrades to multiple custom systems.

### TURNING THE NEXTCITY VISION INTO REALITY
The NextCity vision is built on a model for real-time data gathered across a transportation network. From this vision, Cubic has developed a back office that integrates emerging payment methods and information modules with legacy systems and existing transportation infrastructure. Cubic, in building a modern IT solution, integrates the best and widely used third-party applications to produce a flexible but extremely secure solution. Simply stated, it is the future of transportation payment.

This approach makes it possible to integrate payments and information management across separate operators or agencies in a city, region or state.

It also supports all modes of transportation, so managers can plan and optimize the travel experience and infrastructure usage of an entire mobility network regardless of mode. Cities are seeing an increase of shared services, including paid services, such as car share, ride share and bike share, all of which use different payment mechanisms. For example, in San Francisco, in October 2013, there were 14 such services. These separately and collectively could benefit from one secure payment platform, and the operators could benefit from sharing a larger database of customers with whom to communicate and market services. Travelers will have the convenience and benefits of a single travel account covering all their transportation system use.

## CHALLENGE
Massive quantities of available information are not used effectively for region-wide planning

## VISION
Applying "big data" technology to analyze large datasets from multiple sources to determine actionable changes, predict impacts and optimize all transportation networks in a city

ARMED WITH BROADER PERSPECTIVE AND DEEPER INSIGHTS, PLANNERS CAN MORE EFFECTIVELY BALANCE DEMAND AGAINST CAPACITY WHEN RESTRUCTURING SERVICES.

With always-on connectivity to vehicles and smart card-based fare collection systems, transportation system data is pouring in, but it is not being used effectively. Furthermore, even larger sets of information are available from other sources that are not being tapped.

Traditional techniques for analyzing vehicle data have focused on what happened in the past and, in some cases, what is happening now. Analyzing inputs and outputs—X people boarded at point A and Y people disembarked at point B—from static reports leaves transportation planners guessing about how people actually travel on their entire journey.

The transportation business is characterized by high fixed costs and challenging logistics. Operators and planning authorities need tools to identify cost drivers and the interrelationships between policies, pricing, demand and their services. At the same time, they have to continually reassess their network resource optimization. The potential gains from better use of information in achieving these goals is truly significant.

### BIG DATA'S INFLUENCE
Big data has already begun transforming other sectors like retail and logistics, but it is early days for its use in the transportation industry, and the application of these technologies is fundamental to the NextCity vision.

As the NextCity vision and Cubic Back Office brings big data to transportation, planners can now combine large volumes of vehicle and passenger data with multiple other sources to link trips and look at whole journeys instead of guessing at travel patterns. Their planning will be able to incorporate the relationship between

origin and destination and cross all modes of travel, not just the transportation system.

Data visualization is equally as important to achieving these goals as the new generation of analytics tools, cloud data stores and number-crunching computers. Through the application of innovative state-of-the-art visualization techniques, analysts and planners will be better able to get actionable insights from these massive data sets, model different scenarios and then more effectively communicate the conclusions to other stakeholders, making them far more effective at restructuring citywide transportation networks than they are today.

### PLANNING THROUGH INSIGHTS
Armed with broader perspective and deeper insights, planners can more effectively balance demand against capacity when restructuring services. For example, knowing the origins and destinations of passengers' journeys lets planners determine not just how many people will be impacted by a schedule change, but what their re-route possibilities are to determine the actual time impacts on those affected. That insight lets planners deeply assess the real customer travel implications of the changes they make.

Using predictive analytics, planners will also be able to model policy decisions such as changing the pricing of interlocking transportation and other city systems such as bridge tolls or parking to help optimize resources and throughput.

## CHALLENGE

To more effectively use always-on personal mobile devices to improve the quality of travel experiences and shape demand and behavior citywide

## VISION

Enable agency-branded mobile apps backed by a cloud-based array of support services for everything from mobile payment to real-time updates to incentives

NEXTCITY INHERENTLY PROVIDES THE OPPORTUNITY TO COMMUNICATE IN REAL TIME WITH ALL USERS OF THE TRANSPORTATION NETWORK VIA THEIR SMARTPHONES...

Mobile support by cities and transportation agencies is now a service imperative. A recent survey conducted by Pew Research reported that more than 91 percent of the adult population has a cell phone and more than 58 percent of these are now smartphones. This grew from 46 percent during the period extending from February 2012 to May 2013. Further survey results indicate a very strong correlation between transportation ridership profiles and market segments having higher percentages of smartphone ownership.

Cities and transportation operators are making great strides in using new social media and mobile channels to communicate with their communities, but they are just scratching the surface. The rapid rate of change in mobile technology and the Internet, the non-integrated nature of citywide systems and the complexity and cost of keeping pace with mobile technology and securely implementing advanced payment capabilities such as using mobile devices to recharge their cards or use directly as fare media, are all limitations.

### EMBRACING MOBILE SERVICES

A core component of the NextCity vision is a mobile business system that makes full use of the availability of pervasive mobile devices and their extensive and rapidly changing capabilities. NextCity inherently provides the opportunity to communicate in real time with all users of the transportation network via their smartphones, in-vehicle computers or through dynamic messaging signs and displays, making the transportation network responsive to real-time conditions.

NextCity also simplifies the complexities of deploying mobile services by providing a cloud-based platform that integrates with closed- and open-loop contactless

fare systems, payment processors, mobile networks, NFC platforms, and both iOS and Android smartphones and tablets.

### MULTI-PURPOSE APPS

Transportation agencies can quickly introduce an agency-branded mobile app backed by a cloud-based array of support services that:

- **Leverage Near Field Communications (NFC)** technology to turn a mobile phone into a contactless fare card, reducing the reliance on physical card distribution

- **Enable mobile fare purchases** by turning NFC-enabled mobile phones into the equivalent of a ticket vending machine that can re-load contactless transportation cards in real time

- **Offer customer support** through mobile self-services, including managing all fare purchases; reviewing balances, transactions and fare charges; and receiving notifications about account status and usage

- **Help travelers** plan journeys and receive alerts about real-time travel conditions

- **Generate new revenues** by leveraging advertising and mobile marketing opportunities

- **Shift user behavior** using real-time information and incentives that help balance transportation systems citywide

## CHALLENGE

Changing behavior citywide across all travel modes and using price and incentives as market drivers

## VISION

The synergy from everything above— integrating systems, applying big data and analytics and more effective mobile communications empower cities to manage their transportation infrastructure, using pricing and incentives to change travel behavior and preferences in near real time

SELECTIVE PRICE REDUCTIONS OR INCENTIVES CAN MAKE SMALL BUT MEANINGFUL CHANGES IN TRAFFIC VOLUME AND CONSEQUENTLY OVERALL NETWORK EFFICIENCY.

Congestion charging or raising the cost of entering the central urban core has proven to be a daunting political problem, but what about an alternative approach? When there is a particularly congested corridor, what about offering information about the park-and-ride and transportation alternative and throwing in a coffee coupon for that day? Selective price reductions or incentives can make small but meaningful changes in traffic volume and consequently overall network efficiency.

The industry is seeing an increase in priced urban transportation systems. Travelers are voting with their wallets for better service with a proliferation of new paid services. Imagine if all of them were under the same payments umbrella and the opportunities that would be created to make small pricing changes to affect behavior and volume on congested corridors. That would enable operators and authorities to manage the system through the targeted use of incentives, rewards and fares with the result of affecting behavior to maximize the beneficial use of all modes of transportation within their jurisdictions.

### A RANGE OF SOLUTIONS

These are the collective benefits envisaged in the NextCity vision. Integration allows managers to easily manage pricing policy to their individual and collective benefit across all modes and jurisdictions. The vision of integrated systems will allow the public authorities and regional government to obtain a deeper understanding of travel patterns, behavior and usage and their relationship with time of day, fare levels, incident occurrence and passenger/vehicle volume. Network planning, regulation and policy will be better informed. Coupled with more effective analytics tools, planners will be able to predict the impact of pricing changes.

And with the power of mobile communications, pricing can be modified in near real time to affect traffic flows.

This will require greater cooperation between public and private operators and across jurisdictions, and we recognize the non-trivial nature of this issue. Nonetheless, while the implementation will be a phased process, this level of integration and cooperation is in the best interests of all stakeholders, both public and private.

## NEXTCITY:
## FROM VISION TO SOLUTIONS

Put simply, NextCity is a vision for managing citywide transportation systems, enhancing the travel experience and planning for the future. It is a means of articulating how the developing technologies of today could be used in the future to make urban travel simpler and more tolerable across all modes of transportation.

The NextCity vision is comprised of solutions that leverages Cubic's technology and services expertise, weaving together state-of-the-art technologies that include smart devices, contactless and open payments, mobile communications, advanced business systems and big data:

- **Account-Based Transaction Processing**
  An aggregating system to calculate settlement payments according to mode and operator

- **Data Management**
  A system for extracting and interpreting critical information from devices and systems across the city

- **Customer Management**
  A system for distributing that information meaningfully to customers for their benefit

- **Financial Accounting**
  A clearing and settlement system to ensure all modes are paid for equitably

- **Open APIs**
  A suite of mobile apps and mobile cloud services

Ultimately, the NextCity vision and Cubic platforms offer a set of powerful tools to address these fundamental issues facing cities and transportation operators today and represents the future of urban transportation.

## NEXTCITY: PRODUCT ARCHITECTURE OVERVIEW

The following section provides an overview of the Cubic Back Office modules that deliver the capabilities required to realize Cubic's NextCity vision.

## TRANSACTION PROCESSING

A suite of software modules at the heart of the Cubic Back Office that are designed to work as a system and together function as an end-to-end mass-public transportation fare collection system for multiple transportation agencies.

The system can only accept payment media (i.e. magnetic tickets or contactless smart cards) that carry the agency-specific security keys and is, therefore, not interoperable with payment media from other payments systems. In this offering, the transactions are created by the interaction between the payment media and the reader sitting within the payment device.

The Transaction Processing module includes the fare collection and payments engine, CRM systems, data and information management systems, asset and device service management systems and a settlement and clearing system.

## ACCOUNT-BASED TRANSACTION PROCESSING

A next-generation account-based multi-modal revenue management module designed to work as part of a complete mass-public transportion fare collection and payments system for any transportation or mobility-providing agency or authority. The central system has been designed such that the majority of the software is "common" to all agencies and only specific and configurable parts of the system are agency specific.

Cubic Back Office Account-Based Transaction Payment Processing use serialized payment media (a bank card,

transport smart card, NFC phone, for example) as an account token, and creates transactions centrally, by account, from captured transaction fragments. Any readable device can understand the token with adequate security provisions for communicating in the required protocol.

Account-Based Transaction Processing can co-exist with other legacy payment systems (such as Cubic Transaction Processing) and leverage the other

## FINANCIAL ACCOUNTING

An integrated suite of next-generation Cubic central system products and commercial off-the-shelf (COTS) third-party products, which will serve as an integrated clearing and settlement system. Account-Based Transaction Processing will record all of the transportation journey transactions and output to the Back Office the necessary accounting and monetary adjustments that

need to be made. Financial Accounting will then connect with the banking system to action the necessary inter-agency monetary transactions.

functions within those systems. It can also be deployed in conjunction with other next-generation Cubic modules - Financial Accounting, Customer Management and Data Management.

## CUSTOMER MANAGEMENT

An integrated suite of next-generation Cubic central system products and COTS third-party products, which serves as a web and smartphone-enabled mass-transport CRM platform comprising customer-assisted channels such as retail points of sale, Integrated Voice Response (IVR)/call center systems and customer Information and data repository. Cubic Customer Management will

also include customer self-service channels such as interactive website, mobile website, smartphone applications and Short Message System (SMS) capability.

## DATA MANAGEMENT

A next-generation Data Management module, which pulls data from all operating systems within a mass transportion environment and integrates and presents the data in real-time, interactive information formats to enable transport stakeholders to understand the travel patterns within the city.

## OPEN APIs

A fully integrated mobile module enabling Cubic's customers to deliver a comprehensive mobile travel experience in support of their revenue management activities. With Open APIs, the Cubic Back Office enables transit authorities and other transportation services to offer traveler support, journey planning, ticket purchasing, transportation account management functions to their end-users through a white label solution. With the Cubic Back Office, Open APIs,

Account-Based Transaction Processing and Transaction Processing support mobile ticketing using both barcode and NFC technology and provides the capability for travelers to use their phone to load/add value to existing transit smartcards.

## INTELLIGENT JOURNEY PLANNING

The module responsible for delivering enhanced traveler support services. It is composed of tools that assist travelers by: helping to plan a journey, providing relevant information to inform travel decisions and proactively delivering timely information about conditions that may impact current or future travel.

## NEXTBUS

NextBus provides a highly developed predictive algorithm that provides real-time arrival times for buses, trains, ferries and other modes of transportation based on actual GPS coordinates and historical travel information.  It communicates with travelers in real time and provides operators with performance monitoring of their transportation networks.

## CONCLUSION

In conclusion, NextCity provides a roadmap for a coordinated framework - using legacy and emerging payment methods and information systems to integrate all travel, payment, customer experience, operations and analytic information in the regions for all modes of transportation.

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## CUBIC – A LEADER IN INTELLIGENT TRAVEL SOLUTIONS

At Cubic, we believe our identity is intrinsically linked with our customers, and the people our customers serve. How they get from one place to the next – how that impacts their lives, their fellow travelers and their cities – and how it feels along the way.

That's why we're passionate about developing transportation solutions that improve the way we move throughout cities. Innovation is in our culture, and our history speaks for itself. In our 45-year history, we've delivered public transport fare collection systems to over 450 operators, including 20 regional back office systems, and traffic and transportation management systems for major cities and regions on four continents.