AT&T TECHNOLOGY TRANSFORMATION
BUILDING THE NETWORK OF THE FUTURE

DAVID LU, VICE PRESIDENT
D2 PLATFORM AND SYSTEMS DEVELOPMENT
AGENDA

1. INDUSTRY EVOLUTION
2. FRAMEWORK FOR REPEATABLE SUCCESS
3. DIGITIZATION
4. SOFTWARE DEFINED NETWORKING
5. POSITIONING YOU FOR THE FUTURE
INDUSTRY EVOLUTION
### Emerging Network Trends:

<table>
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<tr>
<th>Global IP Traffic is growing exponentially</th>
<th>Traffic to expand 3x by 2020&lt;sup&gt;1&lt;/sup&gt;</th>
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<td>The definition of a network “Endpoint” is changing</td>
<td>There will be 50 billion connected devices by 2020&lt;sup&gt;2&lt;/sup&gt;</td>
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<td>The Cloud is fundamentally changing wide area networks</td>
<td>93% of businesses are using cloud technology&lt;sup&gt;3&lt;/sup&gt;</td>
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<td>Software-Defined Networking is becoming a reality in 2017</td>
<td>SDN market is expected to reach $12.5B by 2020&lt;sup&gt;4&lt;/sup&gt;</td>
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</tbody>
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Sources:  
1. Cisco  
2. Statista.com  
3. CIO Magazine  
4. Forrester
## EMERGING IT TRENDS

### Enterprise Digitization
- Will reshape competitive landscape
- Organizations with digital strategy up 52% in 3 years

### Use of Private and Public Clouds
- Is growing rapidly
- $1 trillion in IT spending affected by the shift to cloud by 2020

### Artificial Intelligence
- Is beginning to drive IT investment
- Predicted investment in AI will grow 300% in 2017

### Security and IT Risk Management
- Is a top technology concern
- Average increase in 2017 security budgets is 42%

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Sources:
1. KPMG
2. Gartner
3. Forrester
4. Nemertes
FRAMEWORK FOR REPEATABLE SUCCESS
AT&T’S FRAMEWORK FOR REPEATABLE SUCCESS

BIG PLAYS
Enterprise Digitization
Extreme Automation
Platform Driven
Intelligent IT
Security by Design
Capabilities Evolution
Collaborative Workforce

Provide products & services controlled by our customers & managed by our employees, through digital experiences woven throughout our operations & extended directly to customers.
PEOPLE, PROCESS, TECHNOLOGY

PEOPLE
- Application centric design
- Virtual, multi-location
- Layered functional teams
- Domain driven vs. app teams
- Co-located
- Multi-function teams (Product Ops)

PROCESS
- Manual SDLC
- Project governance
- Waterfall development
- Automated CI/CD
- Technical governance
- Agile & DevOps

TECHNOLOGY
- Monolithic codebase
- Application server technology
- VM centric
- Independent mS codebase
- Platform
- Cloud & Container centric
DIGITIZATION
AT&T’S DIGITAL PIVOT

PAST
Complex, single-unit, monolithic solutions

HYBRID
API, data integration glue, intelligent routing

FUTURE
Cloud & mS based, SaaS solutions

ENTERPRISE DIGITIZATION
80% digital by 2020
customer touch points, business operations, internal operations

EXTREME AUTOMATION
Intelligent Triage
Achieve ~60% prediction accuracy in less than six weeks

PLATFORM DRIVEN
Scaled Performance
Deliver 1 trillion transactions per month in 2020

INTELLIGENT IT
Data Powered
Data from 3,000+ applications for real time business ready analytics
AUTOMATION DEVELOPMENT @ AT&T

TODAY

Developer driven Automation

User Controlled & Self Service

Robotics Automation

ANALYTICS

FUTURE

Artificial Intelligence

Cognitive Automation

Machine Learning
SOFTWARE DEFINED NETWORKING
SOFTWARE DEFINED MARKET DRIVERS

HYPER GROWTH

- Data Traffic
- Virtualization
- Progress

75% by 2020
250,000% GROWTH

CUSTOMER EXPERIENCE

Real time control and automation

SOFTWARE DEFINED AGILITY

Rapid feature delivery &
global network elasticity

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SDN & VIRTUALIZATION TRANSFORMATION

GLOBAL & LOCAL CONTROLLERS

VIRTUAL NETWORK FUNCTIONS

CLOUD ORCHESTRATION

WHITE BOX COMMODITY HARDWARE

BLACK BOX
- Proprietary
- Monolith
- Complex Integration
END-TO-END NETWORK TRANSFORMATION

CUSTOMER PREMISE
- vWAN-X
- vFIREWALL
- vSD-WAN
- vROUTER

EDGE ACCESS
- Layer 1 (SDN-ENABLED)
- ETHERNET

CORE NETWORK
- AIC
- vCUSTOMER EQUIPMENT
- vPROVIDER EDGE ROUTER

OVERLAY
- AIC
- vTFAS
- vSBC

SOFTWARE DEFINED HARDWARE

HARDWARE INTENSIVE
- SD-WAN
- WAN-X
- FIREWALL
- ROUTER

MPLS CORE
- GATEWAY ROUTER
- BACKBONE ROUTER
- PROVIDER EDGE ROUTER
- OTHER ELEMENTS

VOICE NETWORK
- CONTROL ELEMENTS
- TOLL FREE APP SERVER
- OTHER ELEMENTS
ECOMP IS ONE OF THREE DOMAIN 2.0 PILLARS

Real-time
Agile customer enablement

Improved efficiency
Reduced cycle times
Innovative services & apps
Faster

NFV
ECOMP
SDN

AT&T Integrated Cloud (AIC) – Shared, Common, Homogeneous

AT&T Internal Transformation – People, Process, Culture
ECOMP PLATFORM APPROACH

Open Platform Approach
- Model-driven Software Architecture
- 8.5M+ lines of code
- Open Source Software Adoption
- Services and Operations as Users

1. Facilitates widespread user development of software apps, products & solutions (reusable software framework)
   a. Core / atomic functions & processes
   b. Micro-services
   c. Re-useable code libraries & tool sets
   d. APIs facilitate solution development

2. Reusable software framework – extendable by users
   a. Provides for user-implemented extensions
   b. Extendable, but core code can only be modified by platform

3. Software platform aims to facilitate service development & reduce operational complexity

4. Functionality & size of software modules remain relatively flat as services scale
MAJOR MODULES OF THE ECOMP ARCHITECTURE

**Design Studio**

- **Service Design**: Rich catalog-driven environment to construct & maintain service & resource definitions, constraints & management processes & policies (recipes)
- **Policy Creation**: Associate anomalous & actionable conditions with automated remedy actions
- **Analytic App Design**: Design capabilities for creation of analytic apps

**Active & Available Inventory (A&AI)**

- **Real-time topology map** with context views of virtual networks, services & applications
- **Relationship context** between components & the network fabric & infrastructure Uses the network resources as the database of record due to their dynamic nature
- **Provides a registration method** used to discover & maintain services & resources

**Data Collection, Analytics & Events (DCAE)**

- **Collects Data & Events** necessary to manage & evolve D2.0 networks & services
- **Makes collected data available** to real-time apps
- **Provides** framework for analytics apps to identify patterns/anomalies & publish events to drive closed-loop control
- **Provides functions at all layers in architecture**

**Master Service Orchestration (MSO)**

- Orchestrates & manages the delivery, modification or removal of networks & services
- Provides cross domain orchestration to optimize the utilization of resources or take broad corrective action
- Interacts with various applications to collect data to determine network facing parameters

**Controllers**

- **Network**: Instantiates, configures & manages the lifecycle of Transport VNFs, infrastructure networking (e.g. leaf, spine & virtual switches) & WANs
- **Service/App**: Instantiates, configures & manages the lifecycle of Service VFs
- **Infrastructure**: Instantiates, configures & manages the lifecycle of infrastructure (compute, storage, etc.)
POSITIONING YOU FOR THE FUTURE
AT&T BUSINESS SUMMARY

AT&T

BUSINESS
3.5 million customers served

ENTERTAINMENT GROUP
30 million consumers

MOBILITY
133 million subscribers

DIGITAL INTERACTION
1 billion YTD

MOBILE COVERAGE
390 million locations

BROADBAND COVERAGE
60+ million locations

150 petabytes
Daily Network Traffic

270+ thousand
Total Workforce

$163 billion
Annual Revenue

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INVESTING IN THE NETWORK OF TOMORROW

140 Years Serving Customers

$140B
U.S. investment past six years
More than any other public company

$146.8B revenue, #12 Fortune 500

#25 in top 50 U.S. patent assignees

On 6 continents, 225+ countries
Together, we’re positioned for short & long term success

Integrated Solutions

Global Scalability

Location-by-Location Flexibility

Technology Leadership

End-to-End Security
THANK YOU