Access Transformation

So why is it such a big deal?

Santa Clara,
September 2019
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Introduction

Who are we?

Salman Ali
Arthur D. Little
Focused on Technology and Innovation Management
- Sectors: Telecoms, Energy, Banking, Travel, Infrastructure
- Topics: Platforms as businesses, Telco Transformation, Open Innovation

Which means
- Observer of changes
- Help clients make the transition

Tom Anschutz
AT&T
Part of the D2.0 team focused on cloudifying the telco
- Leads Telco transformation activities, standards & community development related to all aspects of access networks
- Topics: Open Compute hardware, Open Source software, SDN and NFV

Which means
- He dreams about transforming access networks and then wakes up and gets the job done!
- Affects change globally

Hans-Joerg Kolbe
Deutsche Telekom
Head of Access 4.0 DevOps Org
- Chief Product Owner Access 4.0
- Co-responsible for system design and architecture
- Leading transformation
- Topics: SDN, NFV, CORD, Access, 5G, WhiteBoxes, Cost engineering, Standards & OpenSource

Which means
- He gets people to agree on important stuff!
- Knows how hard it is!
- Creates impact

David Artuñedo
Telefónica
Founder & CTO Onlife Networks
- Internal Startup of 15 people using NFV/SDN technologies on OCP Hardware to rearchitect Telco Central Offices.
- Topics: Edge Computing, services personalization, access networks virtualization (mobile and fixed)

Which means
- Must manage complex organizational issues with high uncertainty
- Owns a P&L and must deliver on targets and KPI
Introduction

We have come together to explain why access transformation deserves a lot more attention

A little bit of context

- AT&T, Deutsche Telekom and Telefónica have been collaborating on this topic since 2015
- Broad alignment on direction and objectives, but differing approaches on (i) Software stack and (ii) business drivers i.e. cost vs. revenue focus
- In Jan 2018 the parties agreed to develop a joint paper to share learnings and encourage community development
- Kick-off in Darmstadt in Feb 2018, team and contributors
  - Arthur D. Little: Salman Ali, Mariana Atilano Carlos Mira, Jesús Portal
  - AT&T: Tom Anschutz, Mitch Olson, Earl Pope
  - Deutsche Telekom: Bodo Jacobs, Hans-Joerg Kolbe, Manuel Paul, Robert Soukup, Fabian Schneider
  - Telefónica: David Artuñedo, Alfonso Carrillo, David López Meco, Patrick López

Who dares wins!

How access transformation can fast-track evolution of operator production platforms

### The challenge

**Major forces** are reshaping the telecoms industry

<table>
<thead>
<tr>
<th>Forces for change</th>
<th>Challenges facing Operators</th>
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</thead>
<tbody>
<tr>
<td>Demand growing faster than revenues</td>
<td>..... low willingness to pay for plain vanilla-networking services</td>
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<tr>
<td>Technological convergence pushing open DC technologies, tools and techniques as alternatives to proprietary technology</td>
<td>..... It is not yet apparent what is the right architecture (and hence skills) for competitiveness in the future. No credible supply chain, mass restructuring is a sensitive topic</td>
</tr>
<tr>
<td>Increasing value generated by 3rd parties: OTTs, cloud players and ecosystem players; and Operators want in!</td>
<td>..... even if the figurative “Killer app” was known, most Operators would be unable to execute: footprint focus, funding and governance, procurement and hiring challenges limit ability to address new opportunities in a timely manner</td>
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</table>
The origin of the problem is how the industry innovates.

**Network engineers**
- Cost driven stability culture
- Interoperability- and compatibility-focus
- Specification driven by SDOs (vendors and operators) determine the roadmap, setting direction + pace
- Developed through consensus building

**Cloud nerds**
- Speed and scalability culture
- Designs developed drawing on community: Opensource software and hardware
- Constantly looking for the proprietary edge vis-a-vis cloud competitors and Own the roadmap
- Software engineering cultures: if it aint good enough show me how to do it better

**Modus Operandi**

**Outcome:**
Complex and detailed specs that balance conflicting interests of operators and vendors rather than emphasize innovation.

Solutions that are engineered for purpose
Creating architectures that are immiscible

The challenge

As-Is Operator Stack

Cloudified Stack

Service Delivery Platforms (SDP)

Proprietary Core per SDP (QoS, Billing)

Multitenant backbone network

Metro transport

Access networks

B/OSS SDP 1

EPC 1

AAA1

PCRF

Operator Data Center

B/OSS SDP 2

MME

AAA2

VPN

Backbone

B/OSS SDP 3

AAA2

DNS

Operator IP networks

B/OSS SDP n

EPC 2

HLR

Internet Peering

Operator Metro

External Metro

Central Office

Switching/routing

OLT MSAN CMTS

Mobile aggregation

Switching/routing

Router BBU RF amplifier

OLT ONT Router

Mobile devices

Fixed devices

Programmable DC infrastructure

Storage Compute Scaling Monitoring

DC Network Fabric

Carrier neutral DC

Freemium Multitenant Apps

Abstracted Infrastructure

Abstracted IP/Transport and access network

OTT provided Consumer interface

Programmable WAN Transport

Internet Peering

Cloud CDN

Global Flat IP Access network

Apps & Browsers
The obvious way ahead

Operators need fit for purpose solutions that mimic cloud patterns

Disaggregation

“Take control” of the production platform
- Built on opensource hardware and software technologies
  - Common architectures that do not distinguish between fixed and mobile
  - Replaces proprietary telecoms equipment with Lego™ like general purpose hardware
- Produce the relevant functions in software, managed by automation tools
  - Drive consolidation
  - Lowers barriers to experimentation

Softwarisation

Softwarize the operating model
- Infrastructure engineered, provisioned, and orchestrated just like cloud services in webscale data centers
- Enables new ways of working
  - Platform based thinking
  - Exploits platform logic to accelerate speed at which products are created and launched
- Use of DevOps techniques to develop and launch services
- Enables platform oriented business opportunities with 3rd parties
  - Latency sensitive workloads

Enable adoption of cloud technologies and aligning the operating model with cloud ways of working

This has lead to numerous designs being championed by as well as others including YOURS
A real alternative is emerging - The stack is maturing to become carrier grade

The obvious way ahead

Inspired by Central Office Re-architected as a Data center project (CORD)
- Modular, all white box design
- Central office pod provides access, aggregation, IP edge, split RAN base band processing, routing and edge “cloud” services
- Engineered for the central office environmental conditions

The converged central office pod “CCOpod”

Hardware stack is performant and mature for the Central Office

The haze around reliability through software is being lifted (aka carrier grade software)

Provides a safe area to incubate new service and business models

Located in the Central Office
So why is it such a big deal?

CCOpod creates new options for everyone from technologists to strategists
So why is it such a big deal?

Procurement/supply chain might see the components as a powerful negotiating tool.

Use of DC grade equipment allows operators to access same economics as cloud ecosystem.

Access to wider Cloud and IT supplier base including OEMs, chip makers & contract manufacturers.

**Traditional OLT**
- Weighted average: $300-700 per port
  - 80% B+ Ports
  - 20% C+ Ports
- Front plane: 280Gbps
- Backplane: 2x40Gbps

**Open compute OLT blade**
- Weighted average: $130-180 per port
  - 80% B+ Ports
  - 20% C+ Ports
- Front plane: 120Gbps
- Backplane: 6x40Gbps
Network engineers will see CCO pod **eliminate functional clutter**...
So why is it such a big deal?

....as well as realize the design is **more cost efficient & scalable**

Example: **Arthur D. Little** converged central office scenario

- 30,000 homes passed (30% connected)
- 21,000 mobile subscribers, 33 4G macro sites per pod

**Rationale**

- Use of hardware
- Lower operating cost and complexity
- Workload and infrastructure pooling

**Virtualized CO**

- Forecast 2023
- High case

**Traditional CO**

- Today

**GPON**

- -50%

- -46%

**Bandwidth/Sub. (Mbps)**

- Concurrent Mobile user

Note: Analysis and statements have been developed by Arthur D. Little in their entirety based on their experience and beliefs and expectations and are subject to significant risks and uncertainties. While AT&T, DTAG and Telefonica have reviewed the model used in this work, we expressly disclaim these estimates or statements and they do not represent our specific approach, strategy or plans.

IF service providers succeed in creating a viable ecosystem of suppliers who support the technology, the following savings are possible in a greenfield scenario.
Product marketers will see something they’ve never had – A **safe place to test ideas** and provide 3rd parties access to the network.

**So what’s the big deal?**

*Born again Product Marketers*

An **Edge Platform** is located in the Central Office, providing a consumable delimited developers platform, in the traffic flow. It provides a safe area to prototype and test new solutions.

**Internal and 3rd party Workloads**

- **Product Innovator Sandbox**
- **vBNG**
- **vOLT**
- **vBBU**
- **Mgmt & control Plane**
- **Spine/Leaf fabric**
- **PON**
- **Line Termination**
- **Generic Compute**

**Located in the Central Office**
So why is it such a big deal?

Allowing operators to **experiment with new value pools** @lower regret costs

### Born again Product Marketers

- Traditional telecoms products
- AR/VR/etc. TV with Pay-per-view model
- Gaming – as Product: gaming platform in streaming
- Wholesale mobile
- B2B Cloud networking (network based SDN)
- B2B Cloud networking and security
- Video processing Services (surveillance, Smart City, etc.)
- Mobile IoT: edge services to host IoT platforms
- Mobile B2B Cloud networking and security
- Storage Gateway
- Advertising Cache hosting
- Edge CDN
- B2C - Security services
- Gaming as IaaS: collocating 3rd party gaming platform
- Edge hosted collaboration tools
- Virtual desktop

### Key

**Product extensions allowed with the pod**

**New edge-based products**
So why is it such a big deal?

Mr Or Ms. Lean might be tempted to **rebuild the entire telco stack at the edge**

Pod as an edge production platform enables legacy platform retirement

Sideline legacy rather than transform

Possible to **branch back** into the legacy stack to smooth over complexities
So why is it such a big deal?

At scale, this may be a new design for a **new kind of telecoms operator**
So why is it such a big deal?

Cloud visionaries might use the platform to develop new niches and/or go global

Cloud peering fabric

On-demand SDN platform which provides a portal, accessed via a web-browser, APIs, Android or iOS apps, to order, activate and manage local, regional, global connectivity with **total visibility and control** and choose from port-to-port, port-to-Cloud, port-to-IX services

Cloud network

Use of overlay networking using a combination of public and private backbone connectivity with 3rd party accesses to data center, public cloud, branches as well as mobile devices

Cloud edge

Allows developers to deploy code anywhere on demand from the public cloud to edge for a range of applications

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Notes

Worldwide

Mainly US

Asia to Europe

US, Europe, Asia

*DC Markets*
(We think) the CCO pod provides **real answers to hard problems**

### Forces for change

1. **Demand growing faster than revenues**
2. **Technological convergence pushing open DC technologies, tools and techniques as alternatives to proprietary technology**
3. **Increasing value generated by 3rd parties: OTTs, cloud players and ecosystem players and Operators want in!**

### How the CO pod changes everything

- Use of DC grade equipment **allows operators to access same economics as cloud ecosystem**
- **Access to wider Cloud and IT supplier base** including OEMs, Chip makers & contract manufacturers
- **Lower operating cost and complexity** through workload and infrastructure pooling
- **Pod as a production platform** to enable legacy platform retirement
- **Provides a safe area** to prototype and test new solutions to intractable legacy systems, services and applications problems
- **Retooling product innovation**: CI/CD A/B testing etc.
- **Catapults carrier production platform to emulate cloud** ways of working, adopt agile DevOps, re-learning and experimentation with technology as well as opensource solutions
- **Potential new revenues** associated with product extensions and new edge based services
Access Ambition

“We develop a cost-efficient, lean-to-operate and scalable access platform to deliver Gigabit products

Renaissance network engineers: Goal is to re-design BB access leveraging data center concepts
- Increase feature agility & automation
- Design based on commodity/open HW and SW where possible, allow for new entrants
- Initial focus is on FTTH/B; Later phases to include DSL/FTTC, edge computing and mobile backhaul/access

Use “Design to Cost” (DtC) principles to lower total costs
- Significantly reduce upfront and lifecycle costs
- Lower the bar for product & service development
- Actively manage cost-to-value ratio from day one

Make it work in the real world
- Set up a dedicated core organization in DT for Access 4.0
- PL-DEVOPS principle applied from beginning
- Learn every day, be brave without overloading scope
- Utilize partners expertise for hardening and production-grade development, while leveraging open-source and community efforts (“Collaborate & Win with Partners”)
  - Run project in 9 agile teams. Main partners: Reply, rtbrick, RadiSys, Community

“Retain deep in-house understanding of all solution components, to allow rapid prototyping”
How to instigate changes

- Network Innovation Center @ Darmstadt & Berlin
- Multi disciplinary focus
- Early transfer into production network
- Collocated teams: DT & Partners
Access Vision

Exploit the transformational power of “Access Network virtualization + Edge Computing”

Seek, develop and monetise disruptive use cases that take advantage of the edge
- High bandwidth
- Low latency
- AI in real time as a service
- Early candidates are video and computer vision

Thought leadership for next generation of edge applications
- Privacy
- Security
- Data Value and control

Develop sticky partnerships
- Cross industry strategic relationships
- Develop and retain early mover advantage: team, know-how, APIs and seek benefits
Initial concepts

| 1 week = 8.5TB saved | 1 month = 36.5 TB saved | 1 year = 443.5 TB saved |

Storage @Edge: Deploying the Storage Gateway at the ISP Edge

Edge is x10+ faster

Uses +70% of Broadband Access capacity
Remote Video Production

LIVE EVENT

NFVI

vCompresson Engine

Media Process Engine

Cognitive Services

EDGE

5G MEDIA

EDGE

5G MEDIA

5G MEDIA APP

5G-MEDIA is a project partially funded by the European Commission Horizon 2020 5G-PPP Programme under Grant Agreement number 761999
AI for Video Analytics

Want you see yourself on the screen? Activate GDPR consent in our tablet!

360° Video

[Image of a 360° video with a concert stage and musicians]
How to instigate changes

Telefónica

- Onlife Networks operates like a start-up
- DevOps hackers, network and software developers, data scientists, working together with marketing and UX experts
- Live customers in commercial network
Access Strategy

Seek to define disaggregated, cloudified, fixed broadband architecture
- Do the easier thing first, learn by doing/deploying
- Build consensus on a community approach through SEBA
- Develop our skills and practices to deploy an open, flexible system with low TCO
- Explore how telcos can engage in community practices and gains

Follow-up with disaggregated, cloudified RAN architecture
- Build on skills developed in wireline work
- Build consensus toward a community approach through O-RAN and COMAC
- Divide and conquer the space by using communities to deliver

Enable hosting of broader edge cloud ecosystem
- Following the same methods as before

Mine convergence benefits from the overall system
- Internal unification
- Seek benefits from technological convergence
How to instigate changes

- Works like a start-up
- Software developers and network engineers working together
Join us

1st step: Be Brave(r)
- Consider all that can be done with an open mind
- Create a stretch program linked to corporate priorities
- Involve all relevant stakeholders in company from the beginning (engineering, operations, planning, finance, purchase,…) 
- Ask for money and staff
- Make a formal commitment (Out loud)

2nd step: Leap (higher)
- (re-) Launch the program
- **Receive support, support** and reshape the community: ONAP, OCP, OEC, TIP, BBF and of course the ONF

Recognize there are no downside risks. The learnings are valuable regardless of the outcome
Arthur D. Little has been at the forefront of innovation since 1886. We are an acknowledged thought leader in linking strategy, innovation and transformation in technology-intensive and converging industries. We navigate our clients through changing business ecosystems to uncover new growth opportunities. We enable our clients to build innovation capabilities and transform their organizations.

Our consultants have strong practical industry experience combined with excellent knowledge of key trends and dynamics. ADL is present in the most important business centers around the world. We are proud to serve most of the Fortune 1000 companies, in addition to other leading firms and public sector organizations.

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