

LIVING EDGE LAB

- OUTREACH SLIDEDeck -

MAY 2017

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EDGE COMPUTING

A NEW PARADIGM WITH DISRUPTIVE OPPORTUNITIES.

Edge Computing

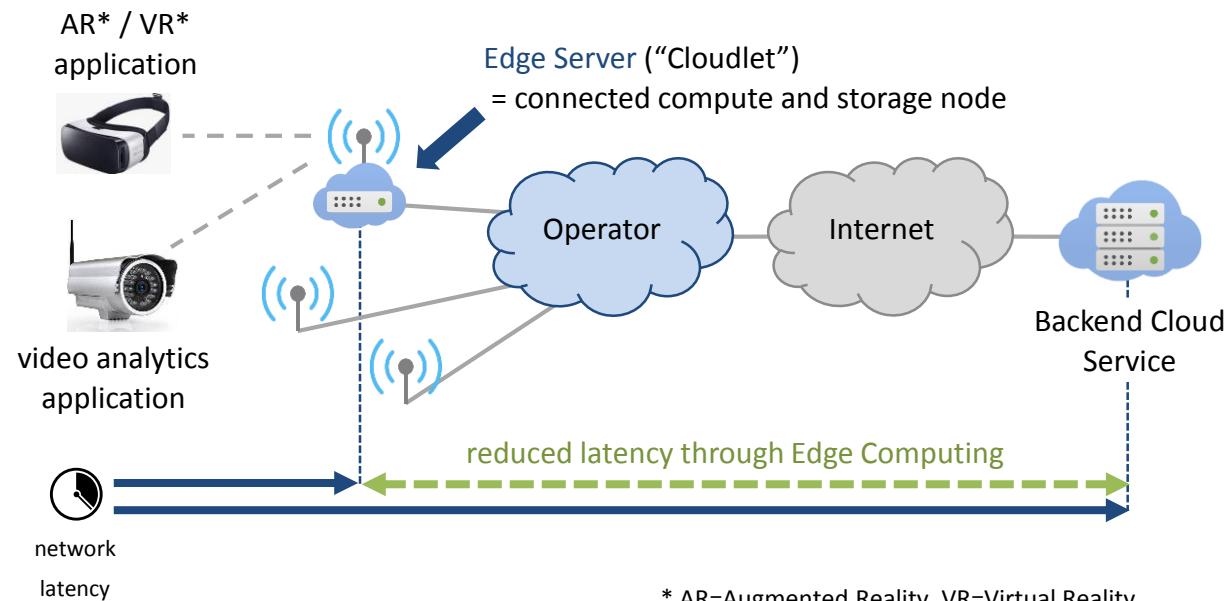
A new network feature that offers connected compute and storage resources (a.k.a. Cloudlets) right next to you – wherever you are!

Benefits

- ✓ **Ultra-low latency:** disruptive improvement of customer experience
- ✓ **Reduction of data traffic:** cloud services (e.g., big data analytics) right at the edge

Implementation has started

- **ETSI Mobile Edge Computing** has more than 75 companies from the IT- and telecom industry jointly developing an Edge Computing standard.
- There are several related **industry consortia** that drive the overall ecosystem development (Open Edge Computing Initiative, CORD, ONOS, NFV)
- The number of **edge solutions and products** is growing rapidly.
- Large **telecom operators** and **cloud service providers** are committed to offer global edge services.
- Many **application developers** and application service providers have started to improve their products with Edge Computing.



* AR=Augmented Reality, VR=Virtual Reality



Source: ETSI MEC, September 2016

LIVING EDGE LAB

BUILDING AN OPEN AND FLEXIBLE LAB FOR EDGE COMPUTING.

Mission Statement

"We are building a **real-world testbed** for Edge Computing with leading **edge applications** and user **acceptance testing**."

LEL

Our Way Forward in 2017

Infrastructure, telco and research team up and **build testbeds**

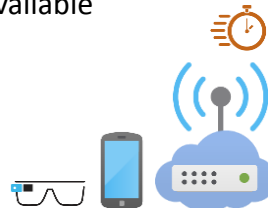
Integration and testing of latest edge computing applications

Application partners join the lab for dedicated test projects

Joint **evaluation and promotion** of results among partners

Key Elements

- **Partnership:** developers for apps, services and devices join forces with telco, infrastructure and research
- **Test Diversity:** various testbeds and latest technology available for a variety of use-case scenarios
- **Open Platform:** edge computing based on OpenStack, vendor & operator independent



LEL PARTNER OVERVIEW

A DIVERSE GROUP OF COMPANIES IS DRIVING THE LAB TOGETHER.

Carnegie Mellon University



Prof. Satya and his team represent the leading **edge-computing research** facility. CMU hosts the **indoor lab** in Pittsburgh, USA. Their **implementation** experience supports LEL partners to get applications up and running more quickly and effectively.

Deutsche Telekom Group



DT's innovation department supports operations and rollout of a fully-equipped **CBRS band LTE** radio test network to ensure **low-latency access** into the lab. Their **network operations** and **telco market** expertise adds value to LEL partnerships.

Crown Castle



CC's large **infrastructure** footprint is the ideal basis for accommodating the **outdoor LEL testbed hardware**, as well as **backbone connectivity** to cloud, cloudlet and testbed facilities.

Intel



Intel contributes highly-performant **edge cloud server** equipment (cloudlet nodes). This allows researchers and application partners to have separate **test environments** and **latest hardware**.

Open Edge Computing Initiative



The OECI is an **industry initiative** founded by LEL partners and others to promote the idea of Open Edge Computing. It offers a common **communication and exchange platform** and keeps a variety of **vendors and operators** in touch with LEL results.

Altistar

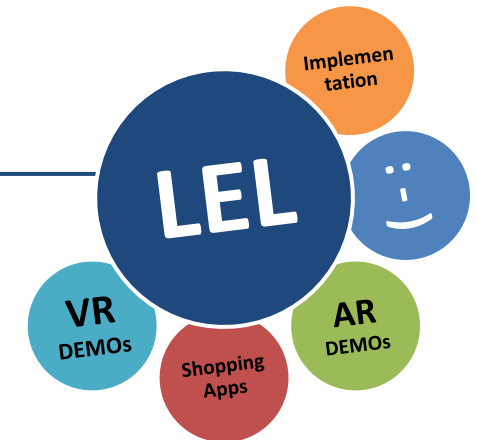


In close collaboration with CC and DT, Altistar provides their latest **LTE hardware** operating on 3.5GHz (CBRS band). Their industry leading **know-how** as RAN vendor ensures LEL integration and optimization during testbed utilization.

...and you ?

We would love to share our passion about edge computing with you!

The Living Edge Lab welcomes your company's contribution!



VALUE PROPOSITION

WHAT IS IN IT FOR YOU?

YOU ARE ...

- **APPLICATION DEVELOPER**
in the space of augmented, virtual or mixed reality?
- **APPLICATION SERVICE PROVIDER**
with a computing heavy service?
- **TECHNOLOGY PROVIDER**
ready to test new devices with edge services and a wider audience?
- **LOCAL BUSINESS OWNER**
willing to pioneer innovative products?

KNOWLEDGE TRANSFER

LEL projects are supported by experienced developers and guided by industry leading experts, e.g.:

- CMU researchers
- Intel scientists
- CC and DT engineers

- sports
- business

- education
- medicine
- research

MARKET SYNERGIES

Take advantage of well established players and their global footprint.

- shopping
- restaurant
- streets & parks
- pedestrian

LOCATION DIVERSITY

Test your devices or services in a versatile environment.

LIVE-USER TESTING

Design and conduct trials under realistic conditions in an urban environment.

PILOT INNOVATIONS FOR YOUR BUSINESS

Boost your traditional business with innovative edge computing applications. Development, integration and trials can be designed as a collaborative project among subsets of LEL partners.

DEVICE AND APP TRIALS

Use the LEL to adapt your product to an open Edge Computing ecosystem based on OpenStack. Test and optimize in diverse scenarios.



TIMELINE

THE LEL WILL BE BUILT IN 2017, PARTNERS ARE WELCOME NOW.

TESTBED ROLLOUT SCHEDULE IN 2017:



OUTLOOK:

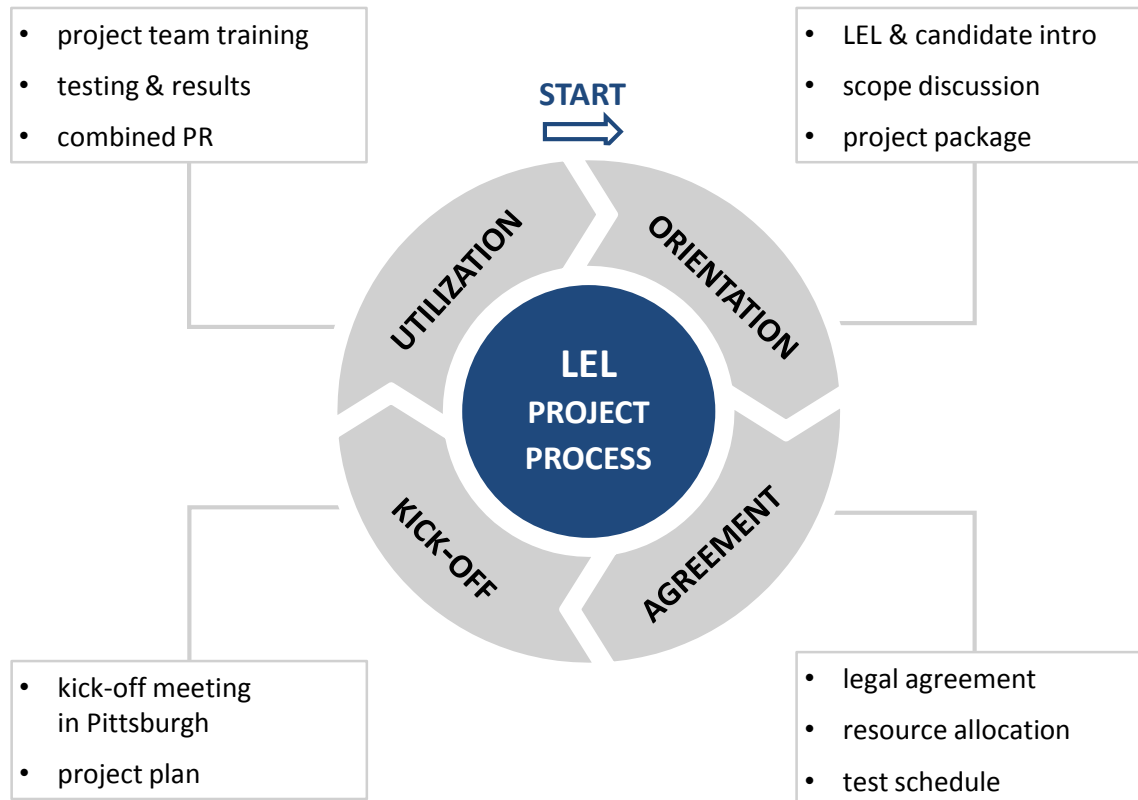
More use cases and sites are being discussed for 2018 and beyond. Creative input is highly appreciated!

A few **examples** are:

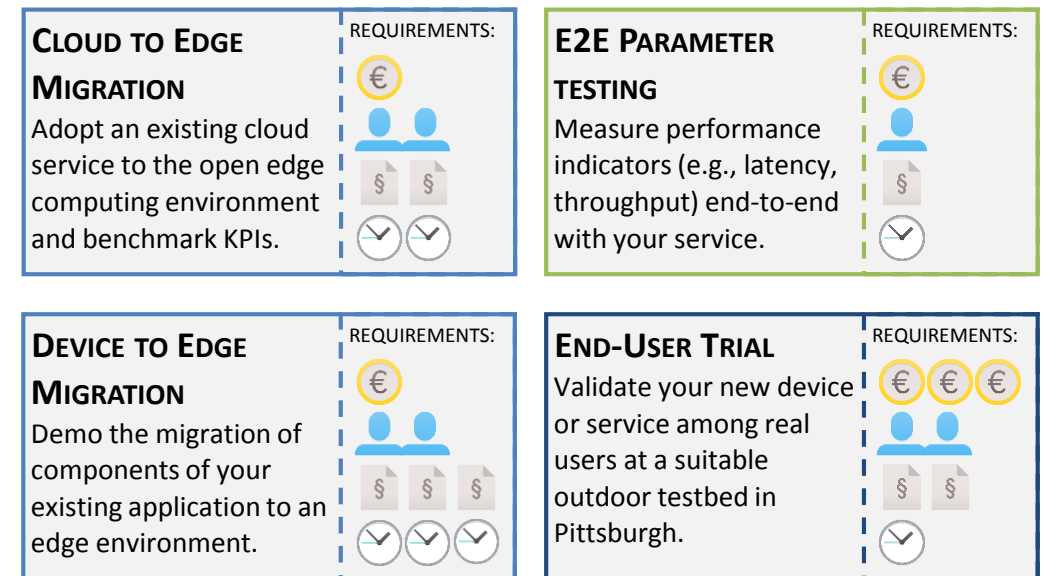
- 4 Hockey Stadium
- 5 Carnegie Museum
- 6 Robotics Lab

ONBOARDING PROCESS

THE LEL OFFERS A WELL-STRUCTURED COLLABORATION PROCESS.



We offer pre-defined **TEST PACKAGES** that illustrate requirements regarding contribution €, manpower , legal framework \$ and duration .
A few **EXAMPLES** are depicted below:



USE CASES

EDGE COMPUTING OFFERS A WIDE RANGE OF APPLICATIONS.

EDGE COMPUTING brings cloud computing closer to mobile users. This enables applications with a demand for both **LOW LATENCY** and **HIGH BANDWIDTH**.

Almost all industries could benefit from this, e.g., by building **AUGMENTED** or **VIRTUAL REALITY** apps, services and devices that become much more feasible with the edge.



The Living Edge Lab community has implemented a broad spectrum of **DEMO USE CASES**. Examples can be found below. **MANY MORE SCENARIOS** will be supported due to the urban environment of our testbeds in downtown Pittsburgh:

EDUCATION

HEALTHCARE

TRAFFIC

LIVE SPORTS

DRIVING

ROBOTICS

SHOPPING

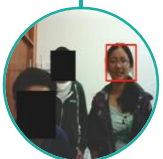


Window Shopping App

Live video analysis and enriched augmented reality with [\[handset\]](#) or [\[glasses\]](#).



PRIVACY



Video Privacy Filter

Face denaturing is applied to video streams using face recognition on a Cloudlet. [\[Video\]](#)



SPORTS & CREATIVITY



Table Tennis Assistant

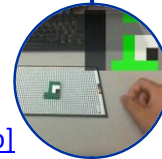
Combines smart glasses, object recognition, motion prediction and real-time instructions. [\[Video\]](#)



Drawing Assistant

Combines object recognition and corrective real-time feedback to the user. [\[Video\]](#)

PRODUCTIVITY



Lego® Assembly

Combines object recognition with giving instructions in real-time. [\[Video\]](#)



Sandwich Assistant

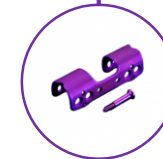
Pre-learned sandwich slice recognition offers instructions to users in real-time. [\[Video\]](#)



IKEA Assembly Assistant

Holograms assist during furniture assembly using smart glasses and object recognition. [\[Video\]](#)

MEDICINE

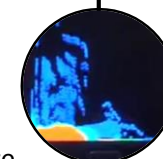


AR Surgery Assistant

Surgery of a broken rib is assisted by image recognition and holographic guidance. [\[Video\]](#)

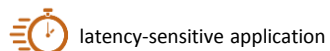


RENDERING



User Experience Demo

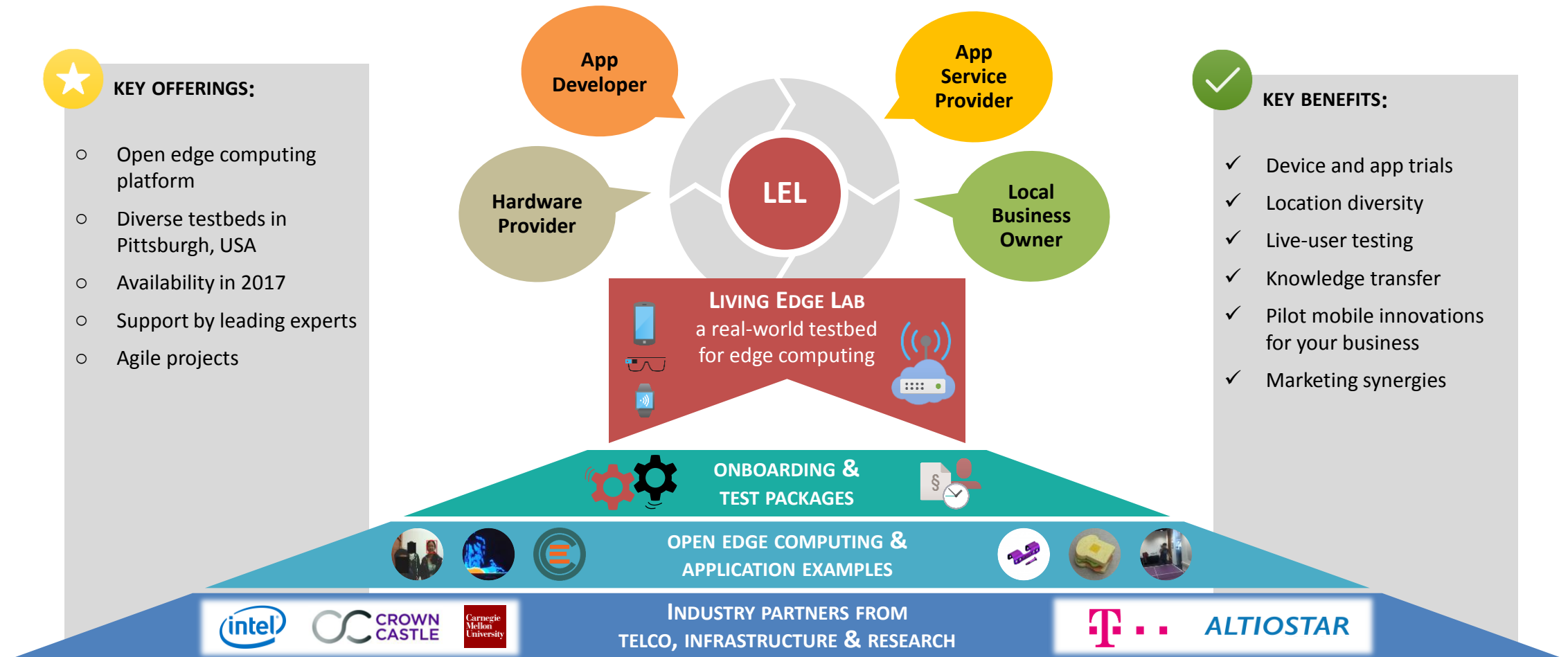
A compute-intensive simulation of particle movement shows how a [\[Cloudlet\]](#) performs vs [\[Cloud\]](#).



latency-sensitive application

SUMMARY

EXPLORE WITH US THE POSSIBILITIES OF EDGE COMPUTING.



LIVING EDGE LAB

FOR QUESTIONS PLEASE CONTACT:



Rolf Schuster

OEC Director

rolf.schuster@openedgecomputing.org