Smart **I**ndustry **F**uture **I**nternet:

The **Fieldlab** approach to explore its value

Leon Gommans, PhD

Science Officer

CTO Office - R&D (ITSTRD)

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Content

Context

Problem & Concepts

What are important science drivers?

Capabilities

1) Lightpath infrastructure
2) UHD video wall collaboration
3) Private global Internet Slices
4) Big Data sharing

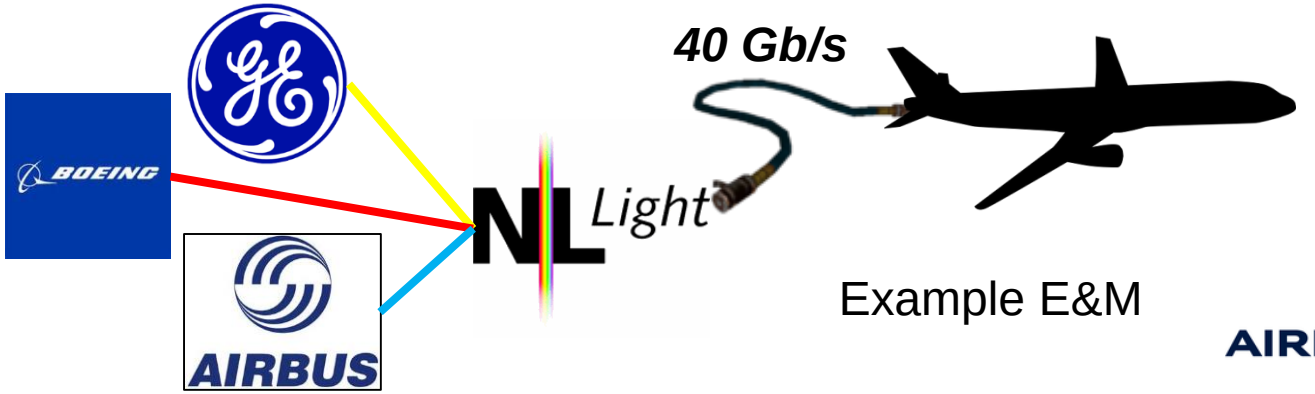
Putting it together

Context

Publically funded research programs seek ***Smart Industry*** use cases to enable knowledge valorization.

*Can academic research into **Future Internet** capabilities help our industry to become smarter?*

- *What* do Future Internet capabilities mean for AF/KL?
- *How: by* creating a ***Field Lab*** using advanced FI capabilities:
  - Global optical network that can provide “lightpaths”
  - UHD video wall based visualization & collaboration
  - Lightpaths allow “Internet slices” to be created across the globe
  - High volume & velocity (big-) data sharing & supercomputing
  - Autonomous cyber defense capable
- *With what:* use cases defined by our business



Example E&M

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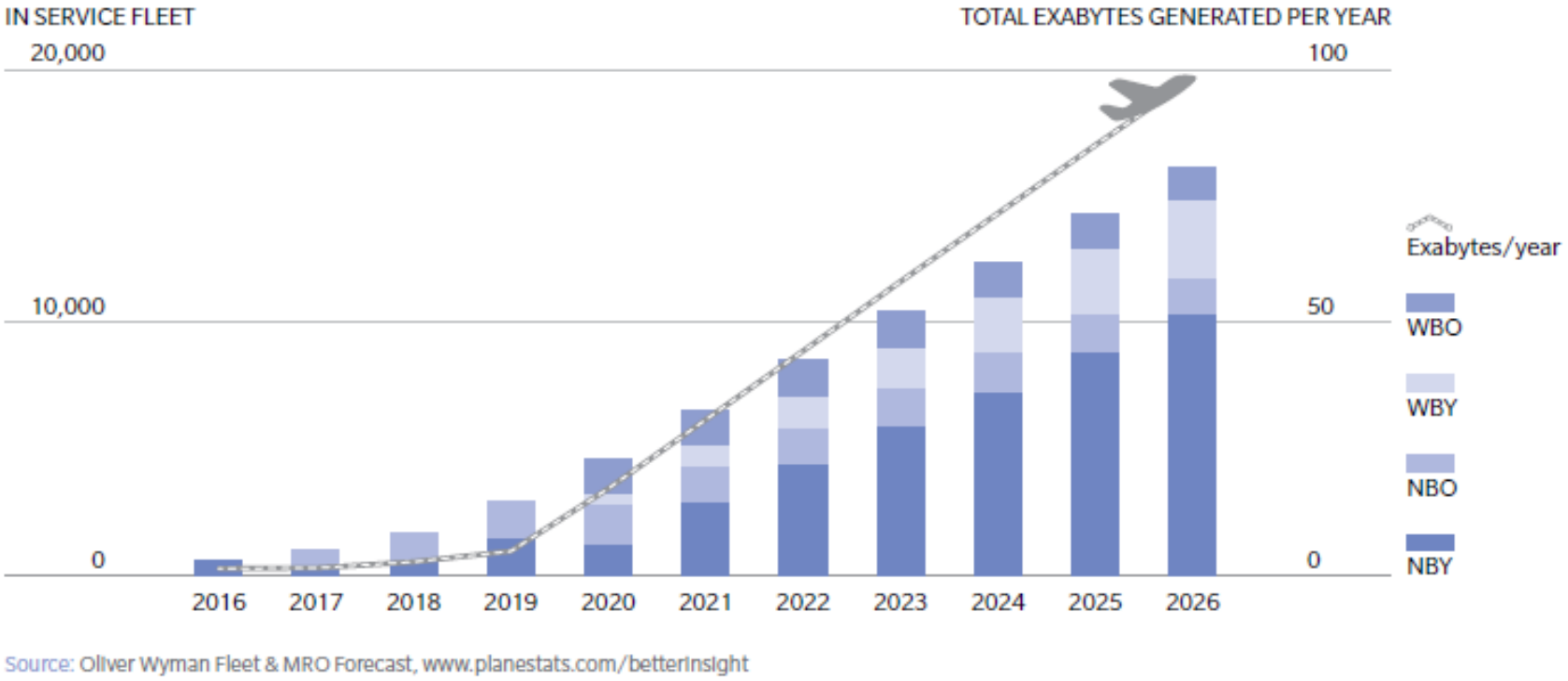
Example: Big Data in Aircraft MRO



Source: Oliver Wyman Fleet & MRO Forecast, www.planestats.com/betterinsight

Aircraft fleet is expected to collect 98 Exabyte of data by 2026.
Main use: aircraft health monitoring and predictive maintenance.

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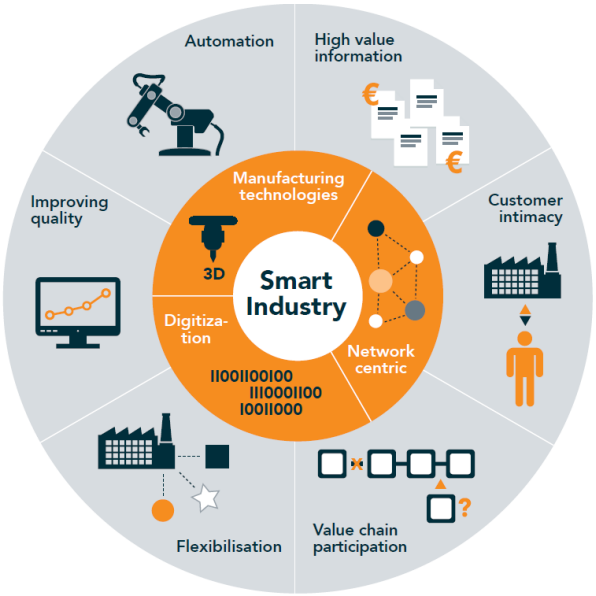
Smart Industries topic

Smart Industries is a general topic, considered by Dutch Minister of Economic Affairs, to address two challenges*:



(1) how can companies collaborate effectively, and are they organized in chains and networks that make optimal use of data?

(2) how do companies **develop new Smart business propositions** with the deployment of new and state-of-the-art technology and knowledge?

*) Action agenda smart industry, Dutch *industry fit for the future*

Report contains three main action lines:
1: Reuse existing knowledge
2: Speed up with **field labs**
3: Re-enforce foundation
- a: Knowledge
- b: Skills
- **c: ICT pre-conditions**

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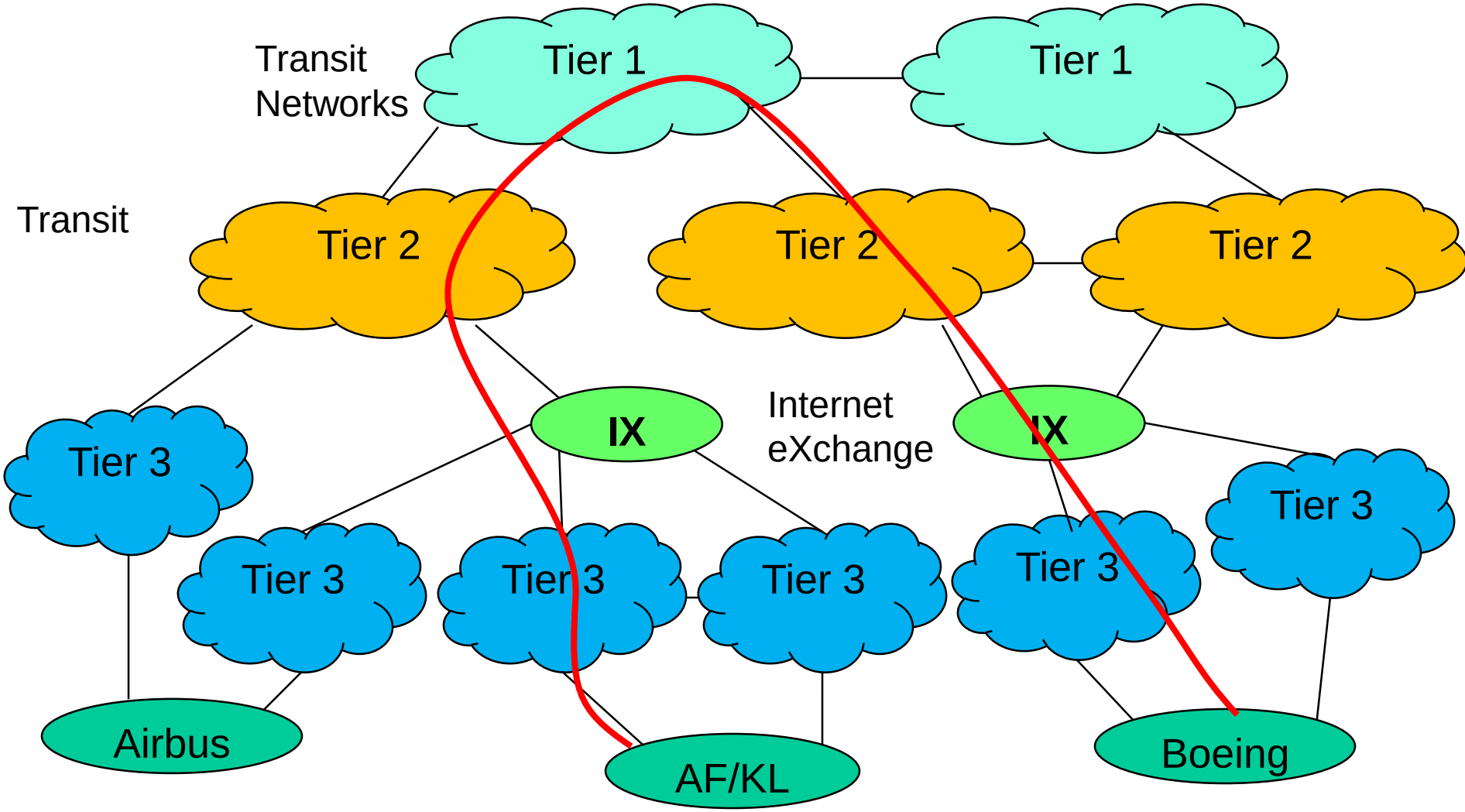
Traditional INTERconnected NETworks

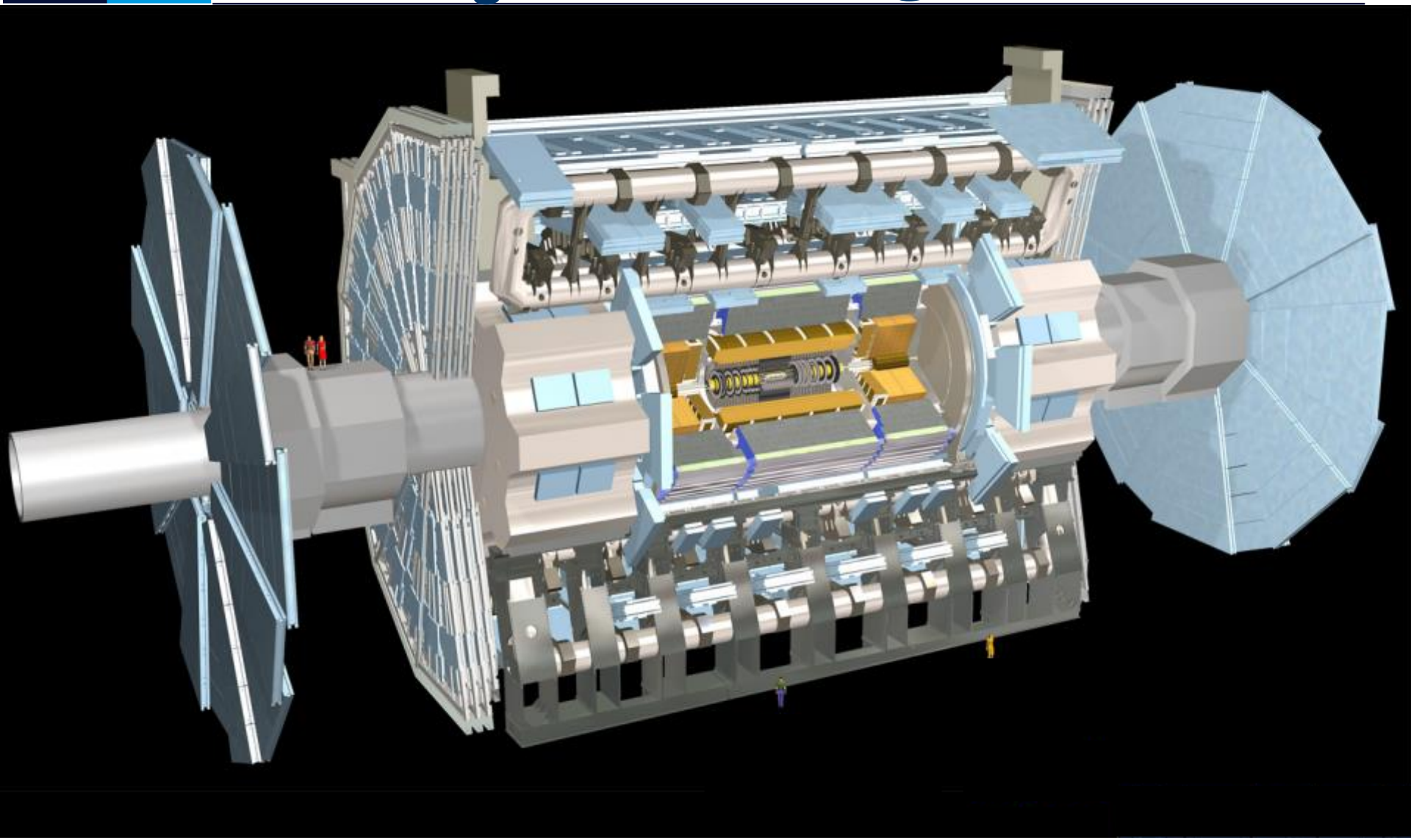


Problem

Requirement to send large volumes of data at high velocity across the Internet from point A to point B will affect other users.

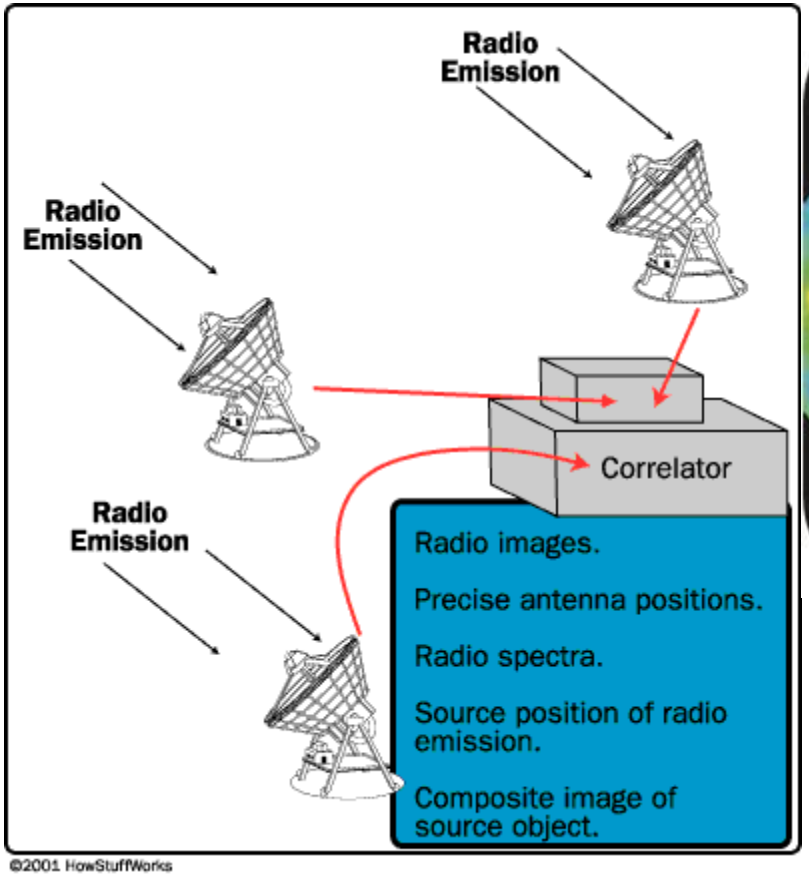
Reason: Internet is essentially a shared “best effort” infrastructure.

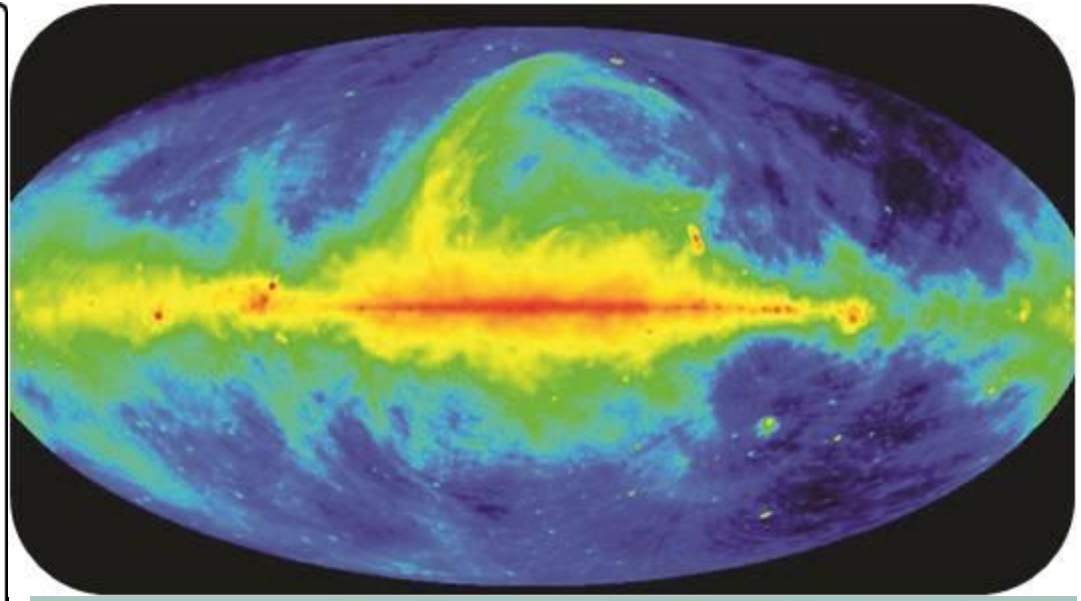
Science Example 1: High Energy Physics Processing detector data @ CERN

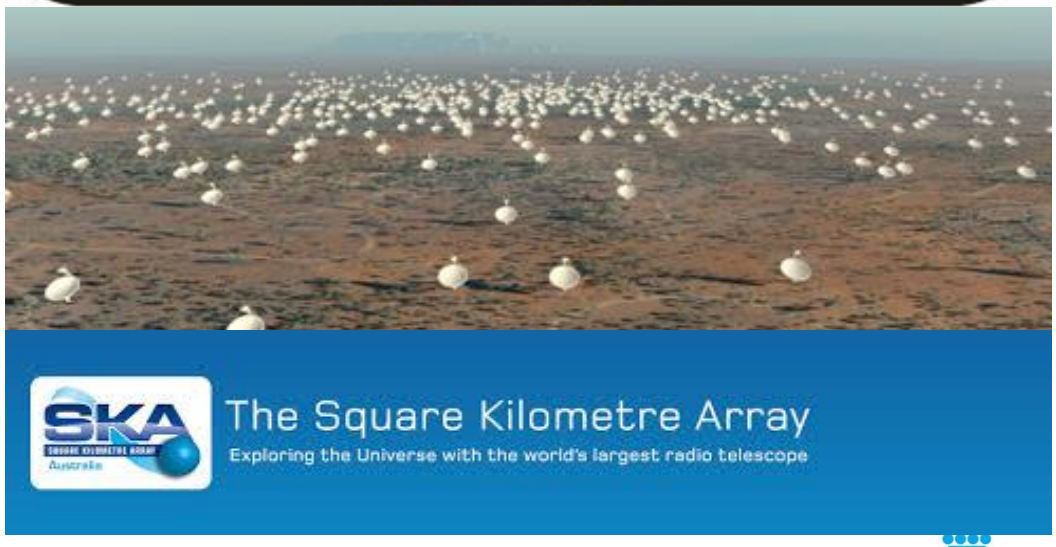


ATLAS: 7000 ton 46m x 25m x 25m detector as one of the 4 LHC detectors
Generates 1 Pb/s of raw data.

Science example 2
Correlating data from radio telescopes

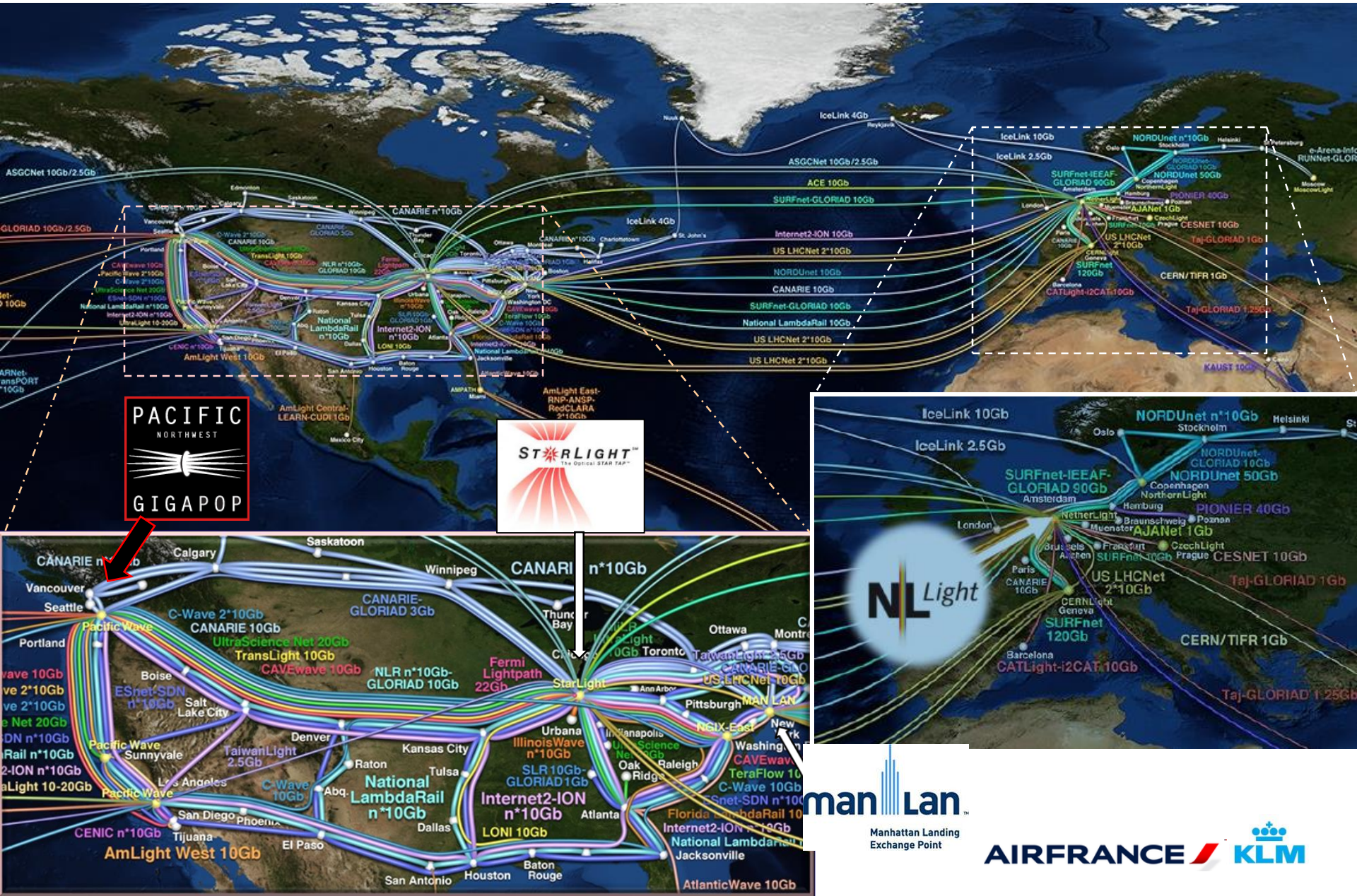






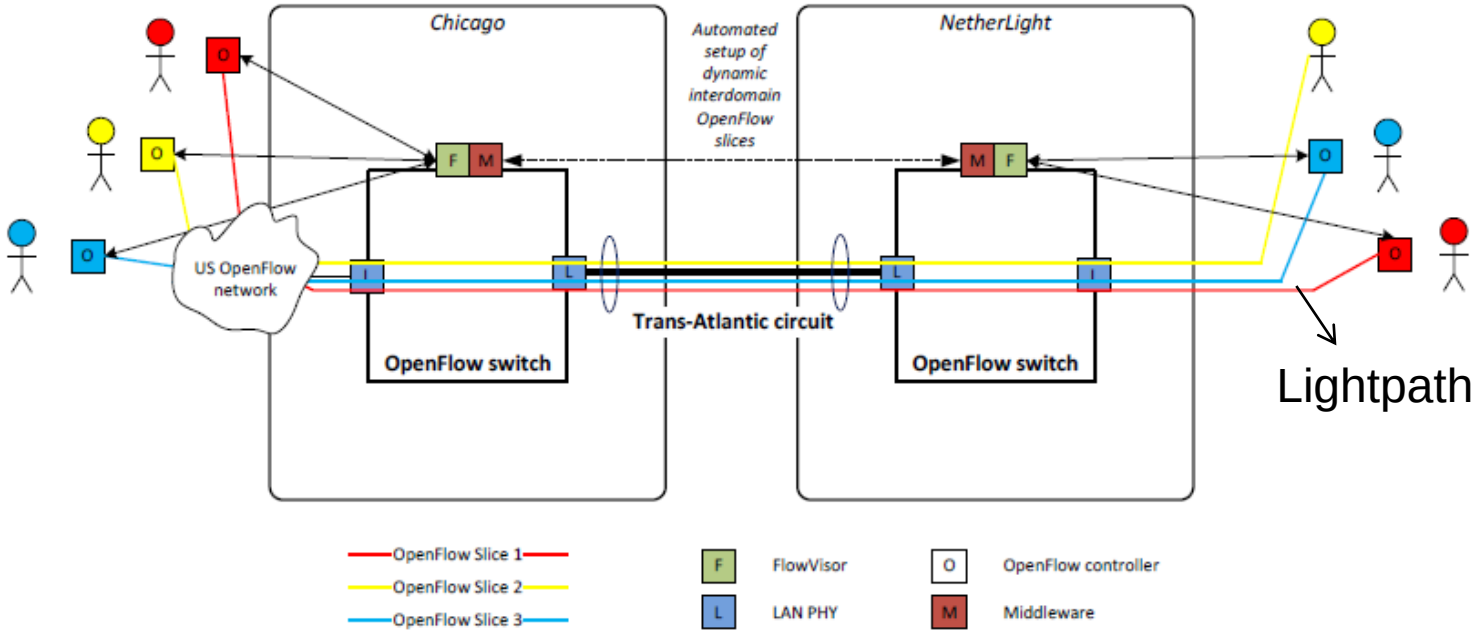
At 190 Gb/s per telescope
SKA is expected to observe
10-100x more data traffic
as the current Internet transports

Science is currently supported by a global Optical Network Research Infrastructure



Capability 1: Software Defined Networking allowing the creation of a “lightpath”

Interdomain OpenFlow slices*



14

* In collaboration with Internet2 and ACE

SURFNET

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Capability 2: UHD visual collaboration

SAGE2 enables groups to collaborate in front of large shared displays that require juxtaposing large volumes of information in ultra high-resolution.

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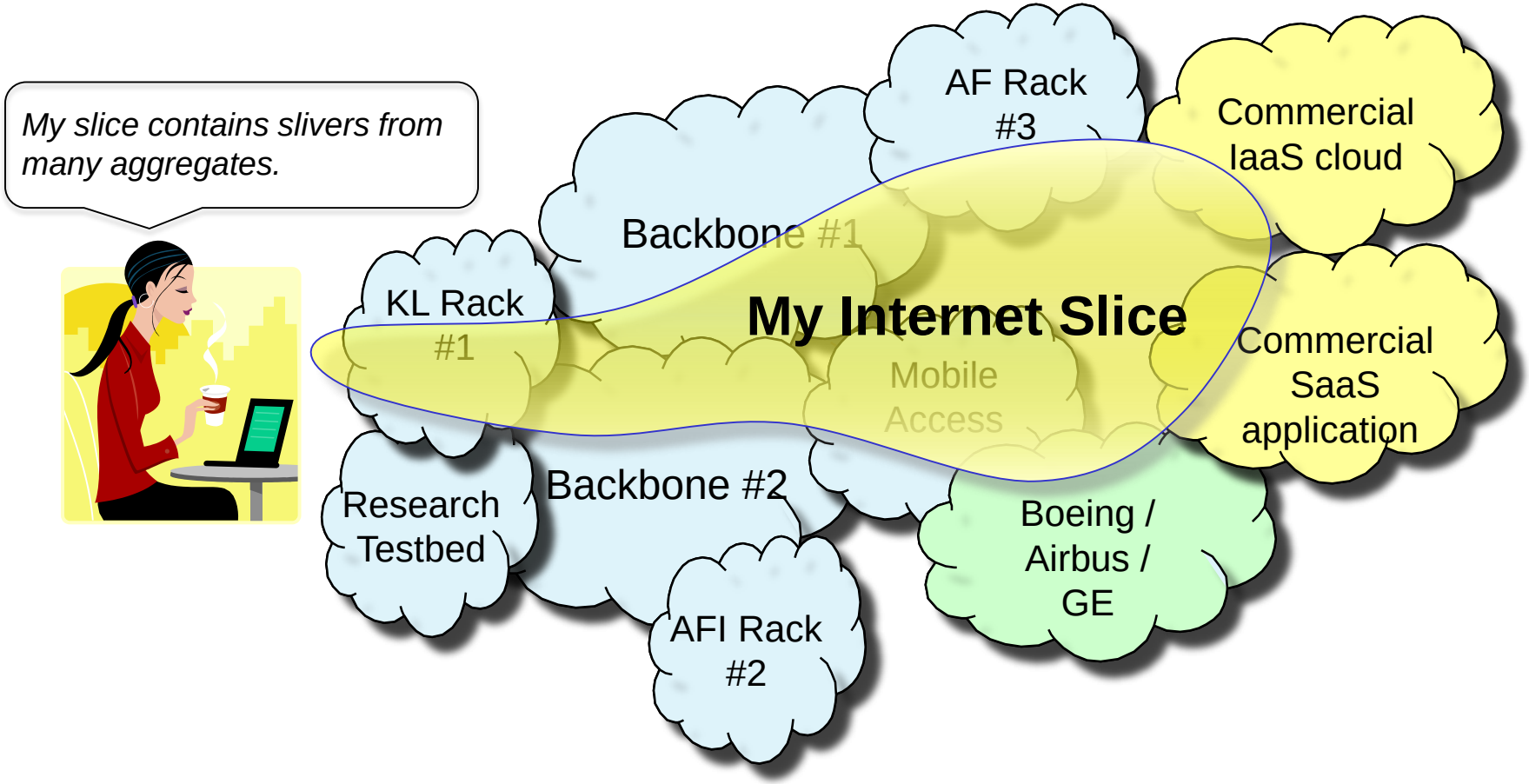
Capability 3: Secure distributed application deployment

The Internet as programmable virtual infrastructure slices that are delivered by multiple autonomous parties



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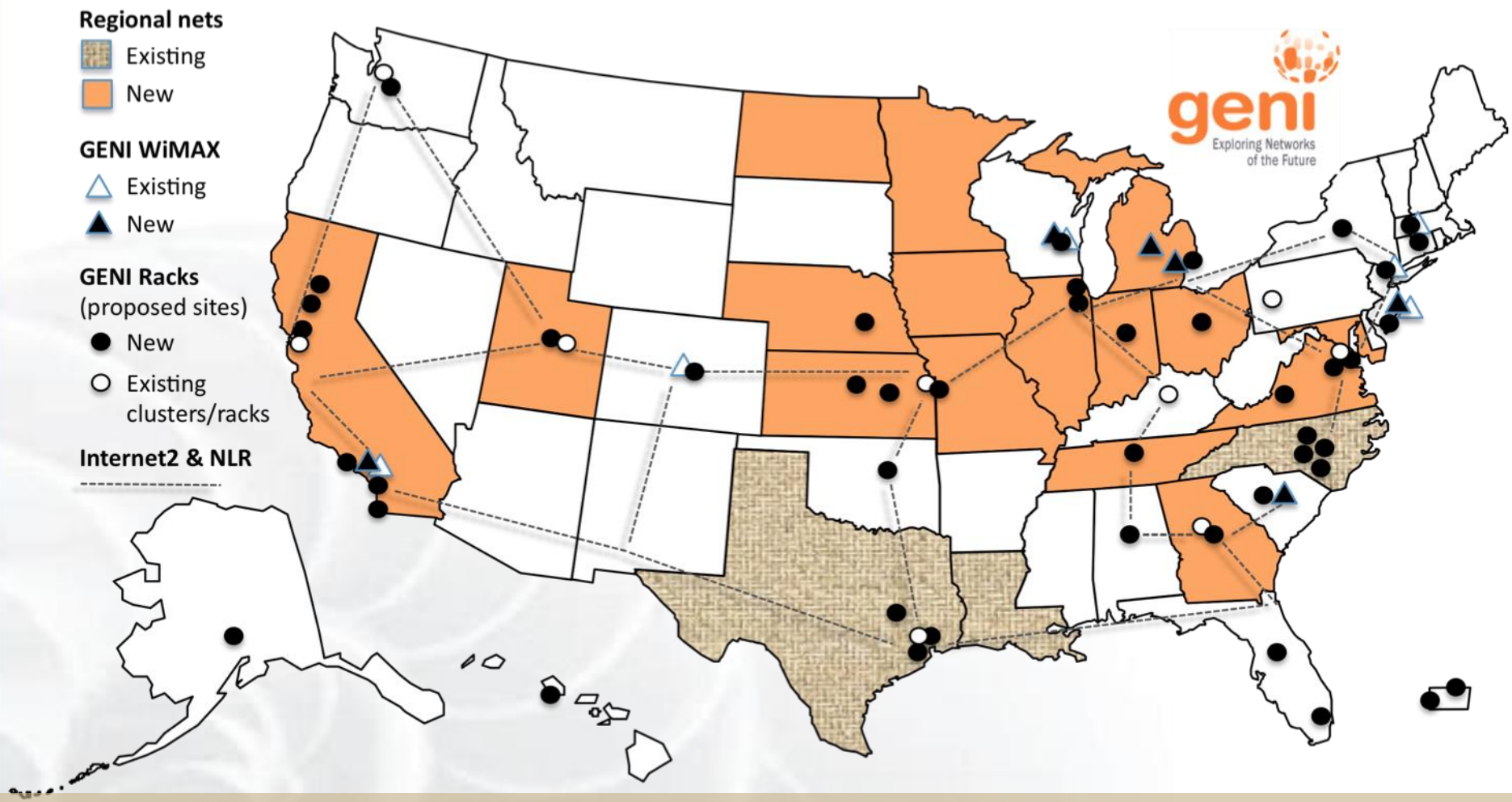
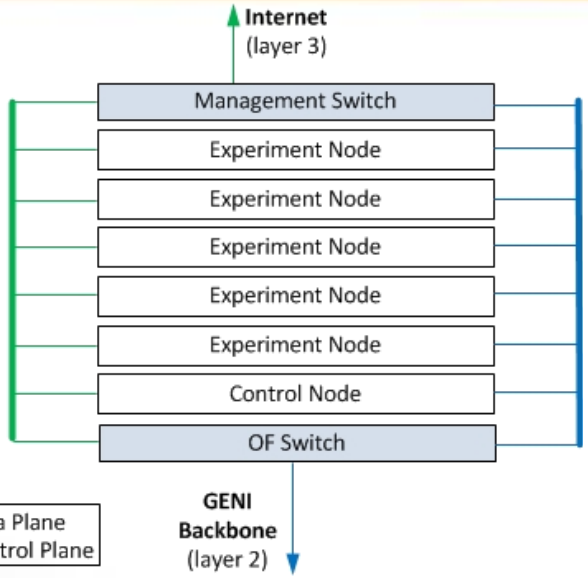
GENI: Infrastructure for Experimentation



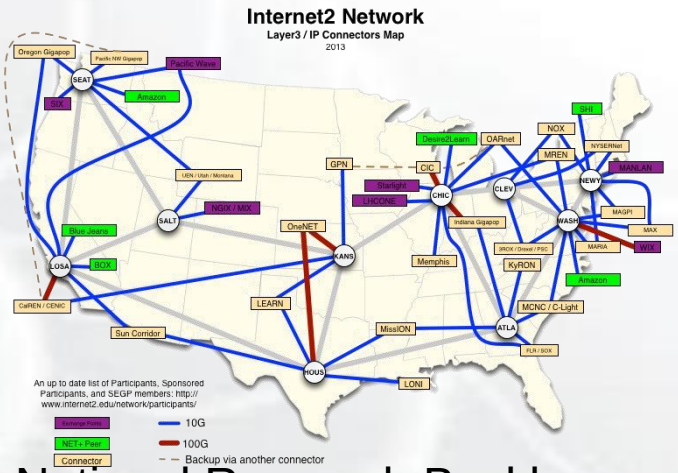
GENI provides compute resources that can be connected in experimenter specified Layer 2 topologies.

GENI Networking Resources

WiMAX
Base Stations



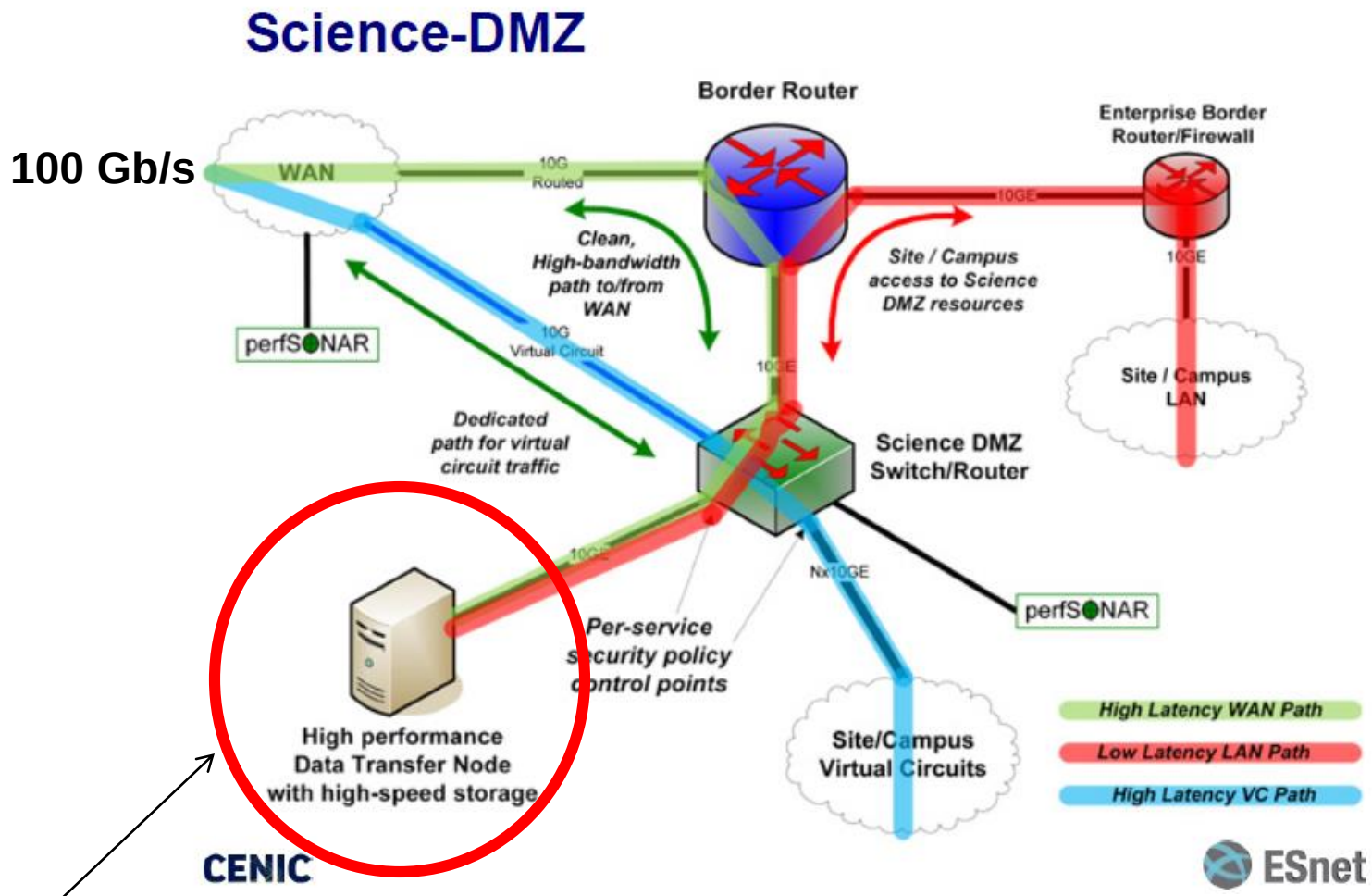
GENI
Rack



National Research Backbones
(e.g. Internet2)

Regional Networks
(e.g. CENIC)

Capability 4: Big Data sharing technology



A Science DMZ is an external-facing, high-performance network with data servers, storing large amounts of data so that collaborating institutions can easily **exchange hundreds of terabytes of data for analysis**.

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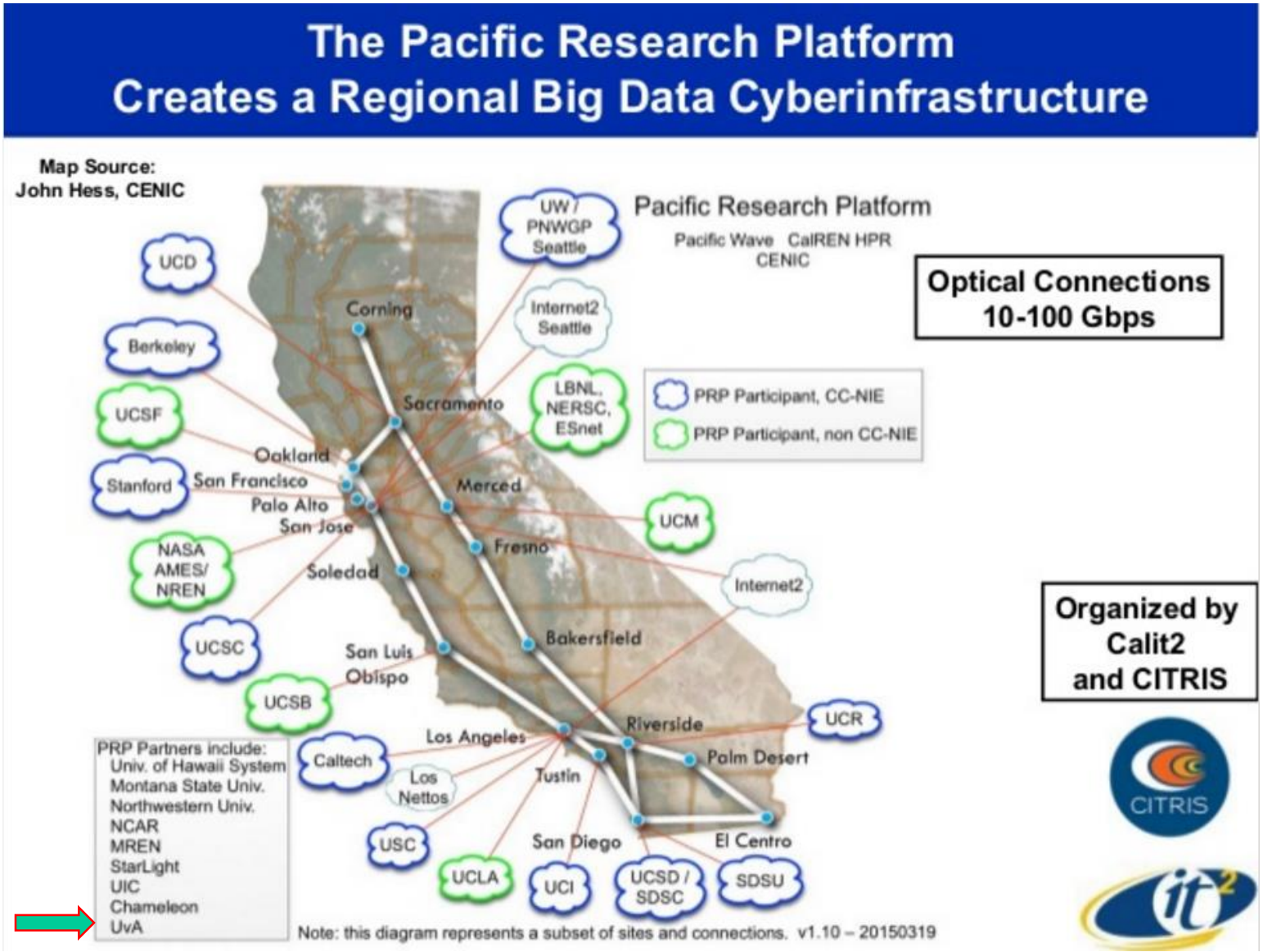
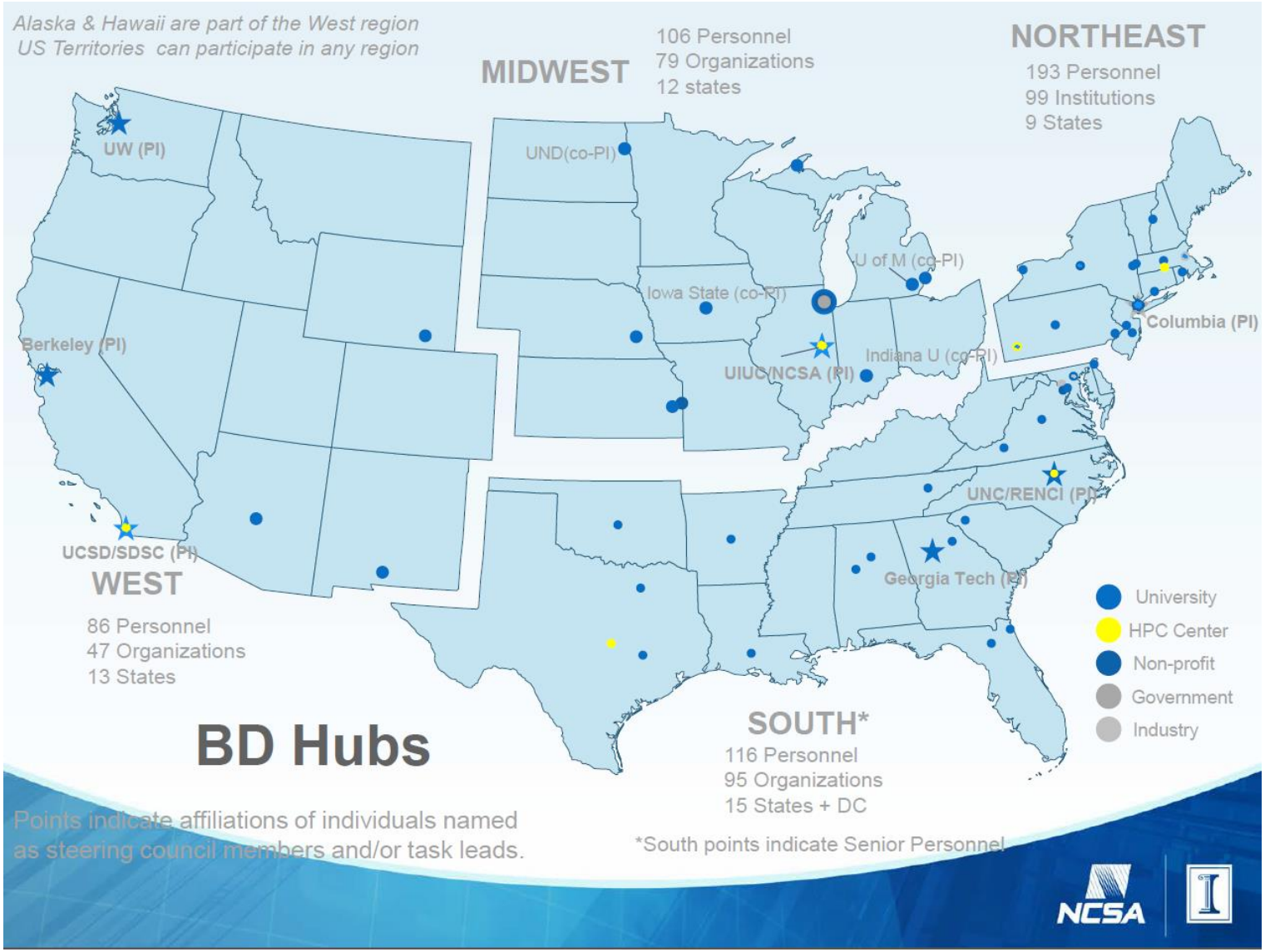
Science DMZ concept adopted in PRP



NSF Big Data Hub initiative



Source: Ed Seidel NCSA

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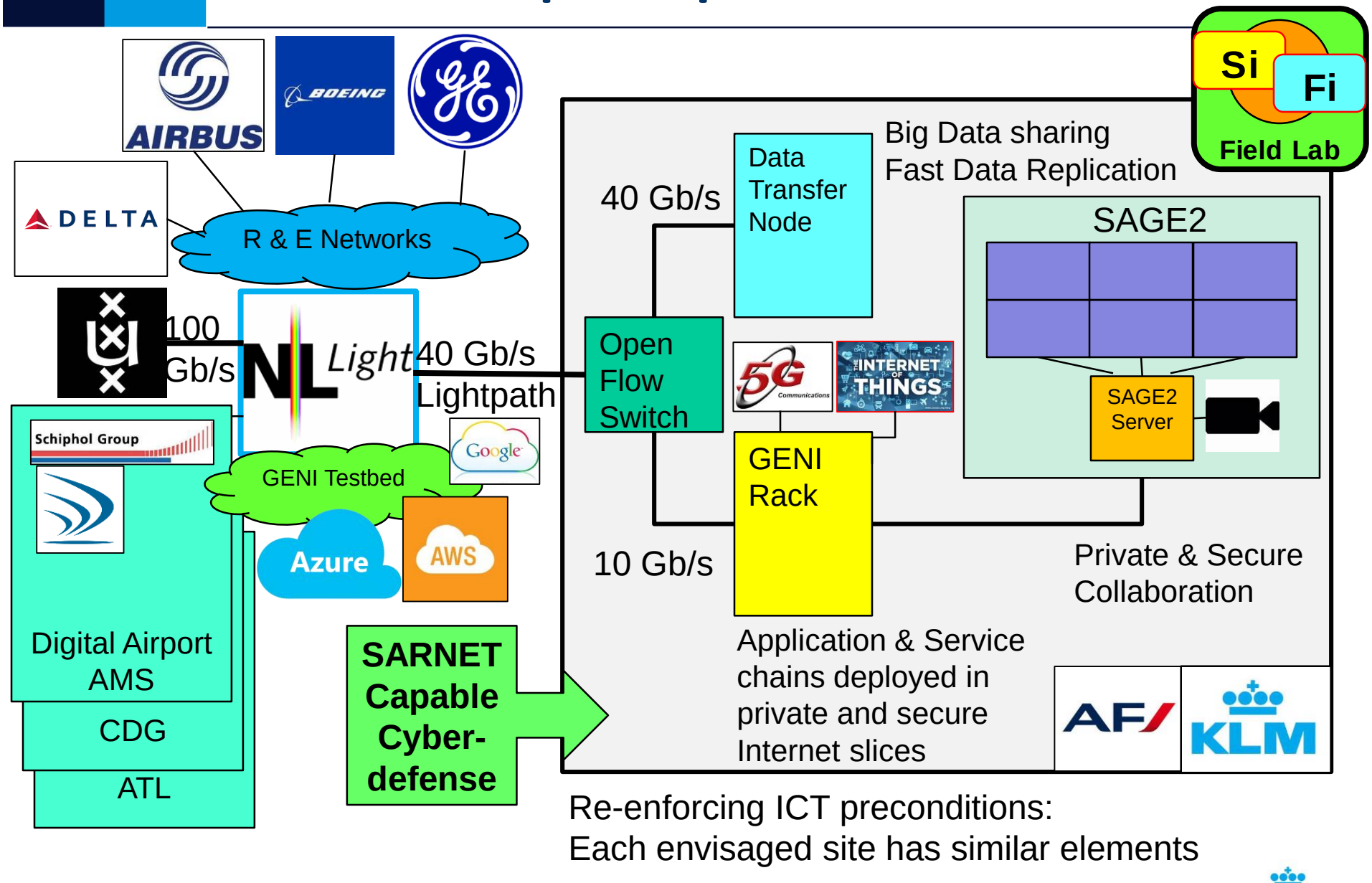
Ambition to put capabilities into fieldlab



Re-enforcing ICT preconditions:
Each envisaged site has similar elements

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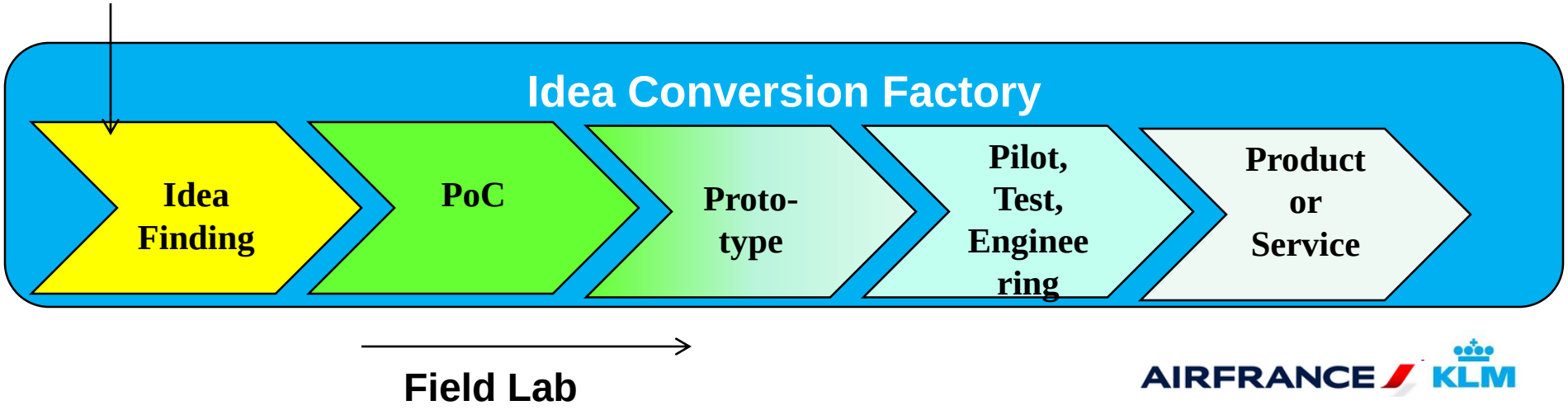
Role R&D office

- Explain mission, objectives and SiFi fieldlab concepts to our business and their partners.
- Establish contacts with Research Institutes and Universities to motivate importance of collaboration.
- Liaise with funding agencies to define research projects to obtain funding.
- Define research projects / questions for students & research groups.



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Questions