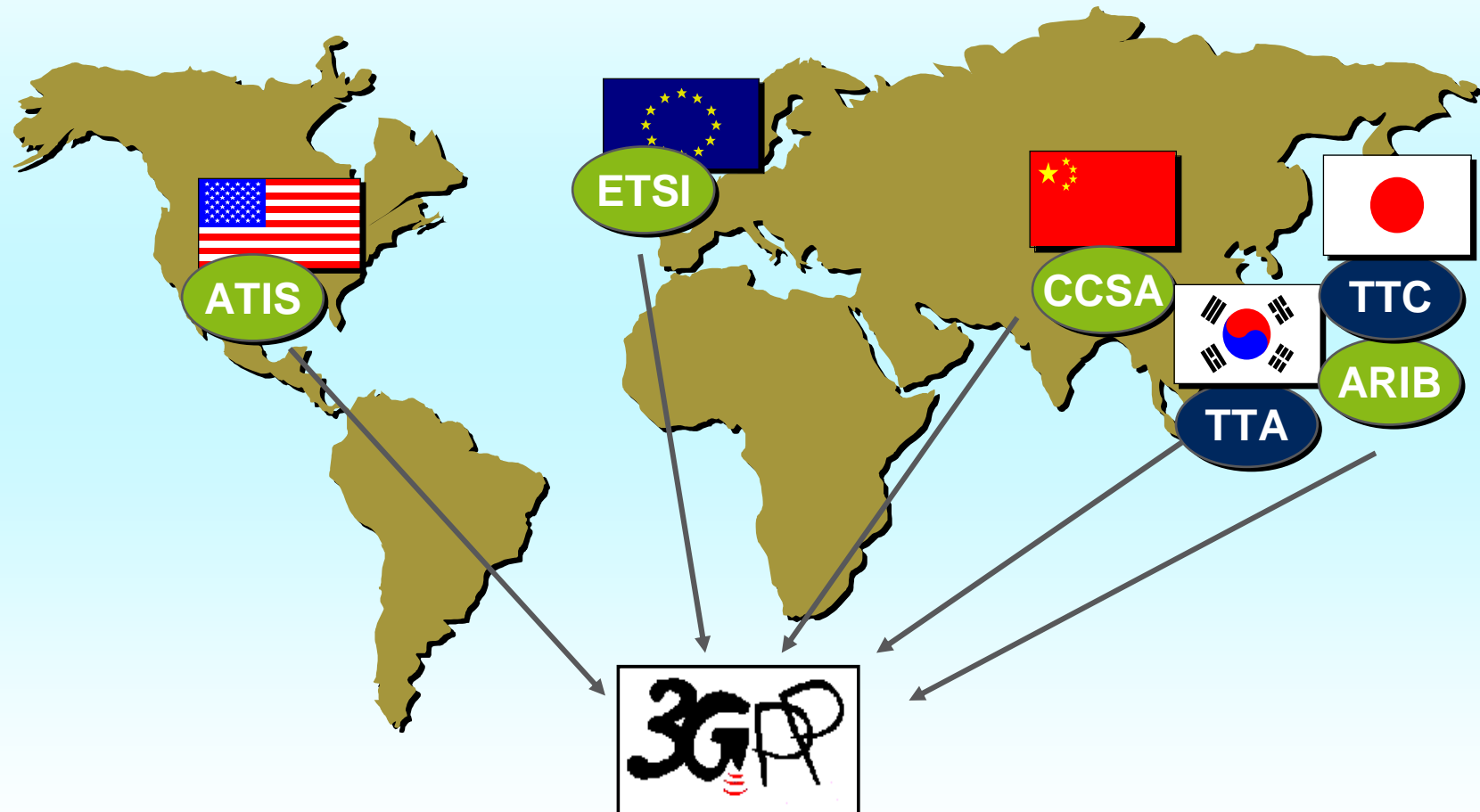# 3GPP Overview

Ali Khayrallah
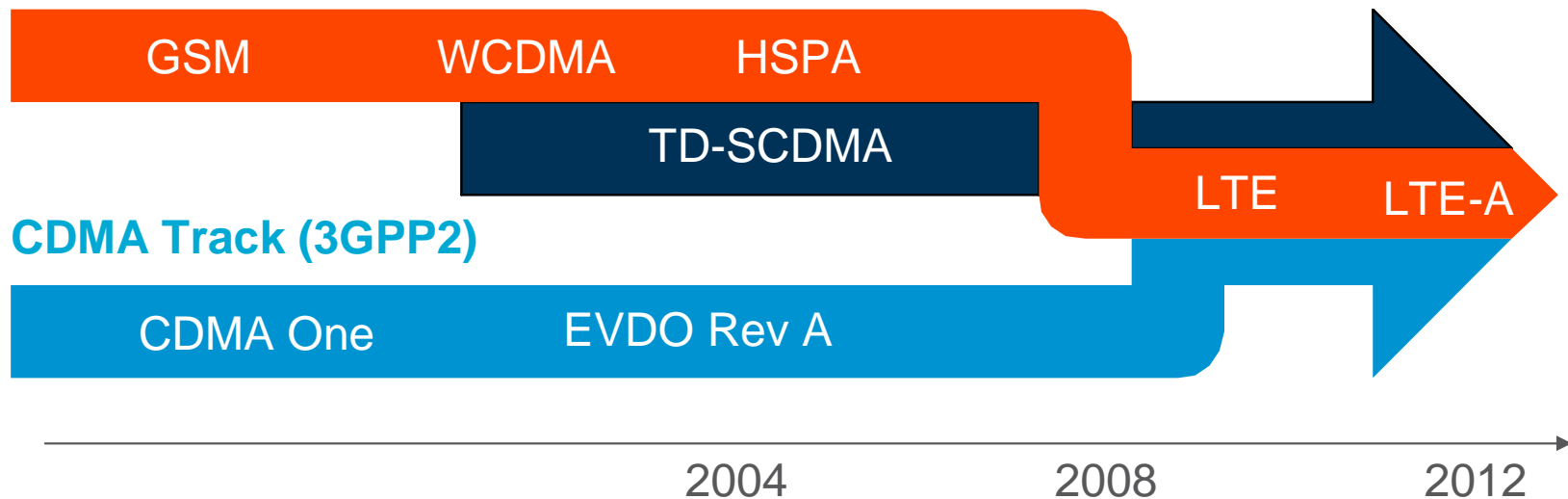Ericsson Research
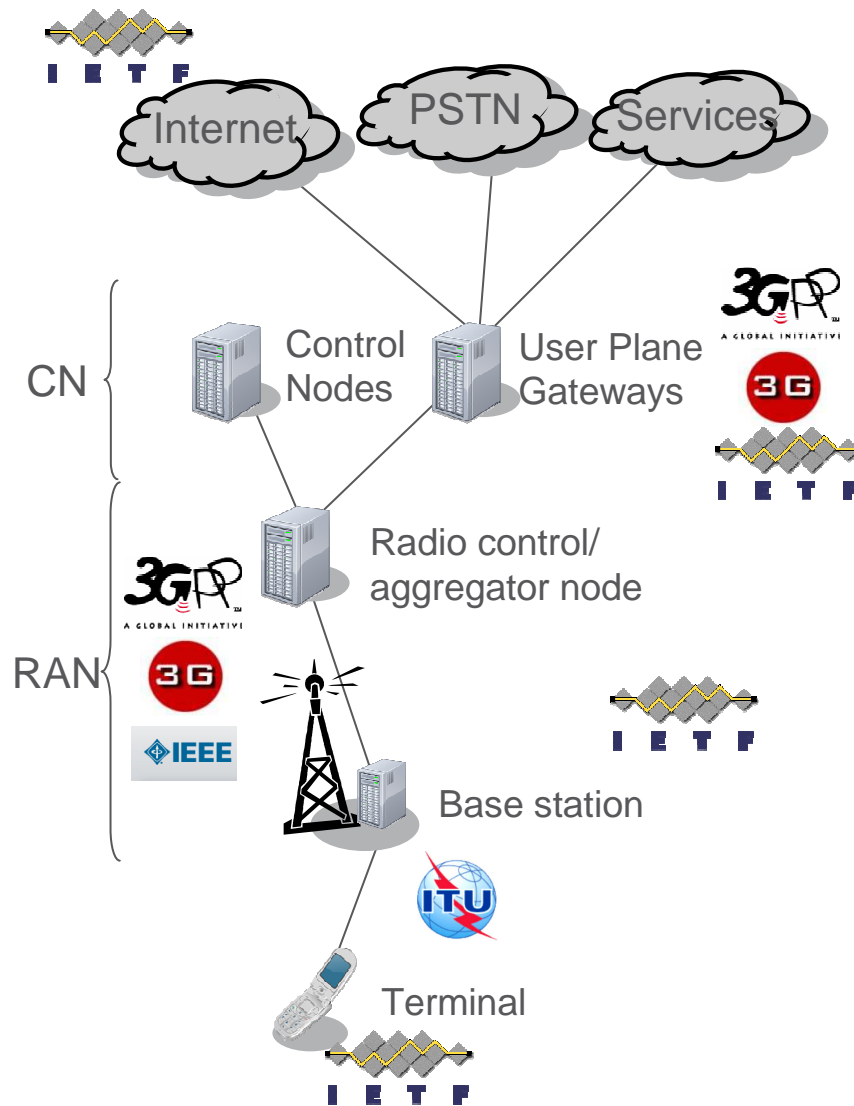San Jose, CA

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3GPP Partners

LTE Convergence

› Global standards – global markets

› Technology innovation on a global scale

› Inter-operability across vendors, operators, countries

GSM Track (3GPP)

GSM	WCDMA	HSPA

TD-SCDMA

LTE   LTE-A

CDMA Track (3GPP2)

CDMA One   EVDO Rev A

2004   2008   2012

Standards in the Network

› IETF
  – Internet services/protocols end-to-end with terminal
  – Transport protocols/functions in Core Network

› 3GPP, 3GPP2
  – Architecture, functions, protocols for complete Radio Access and Core Network
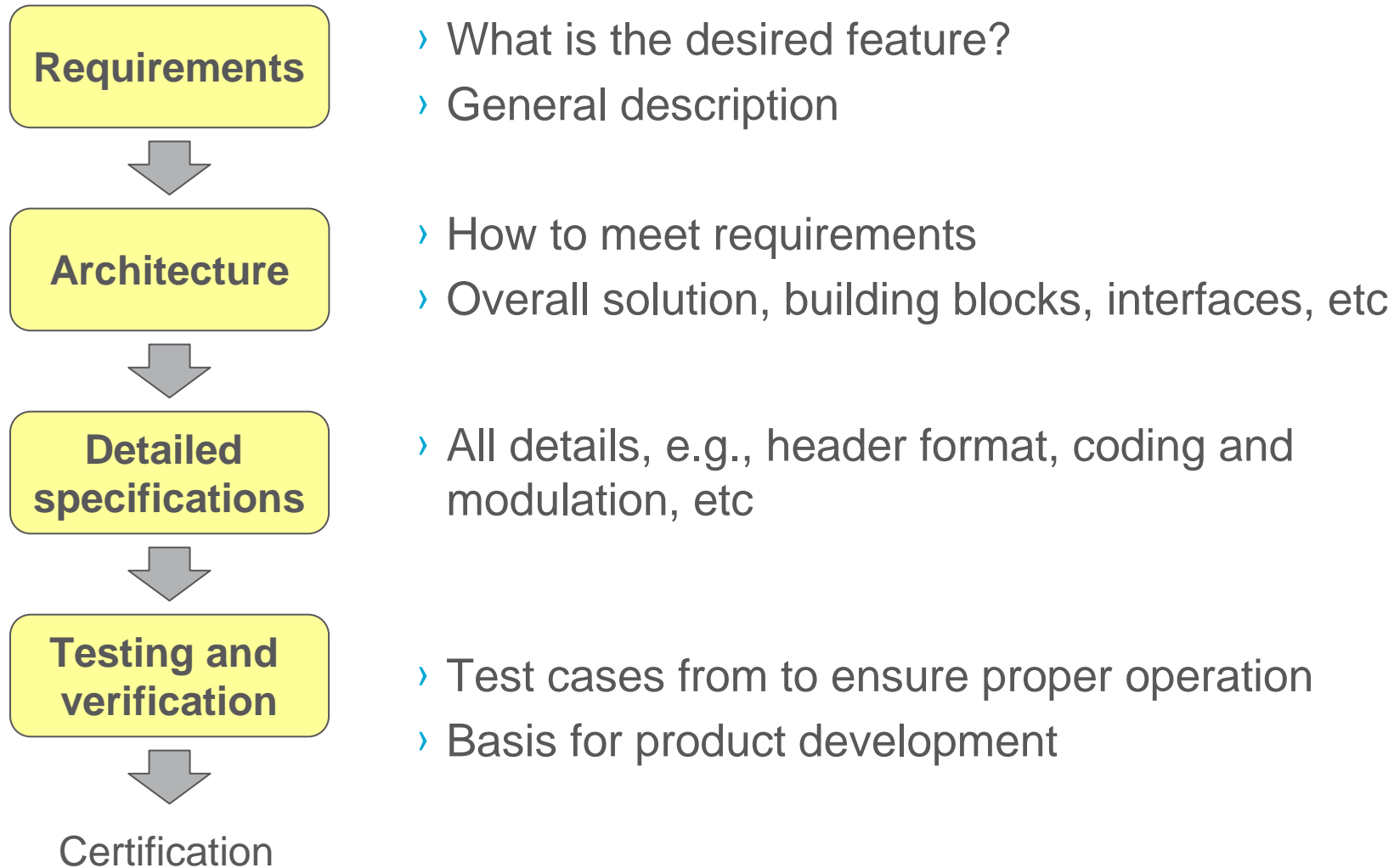
› IEEE
  – Architecture, functions, protocols for Radio Access Network

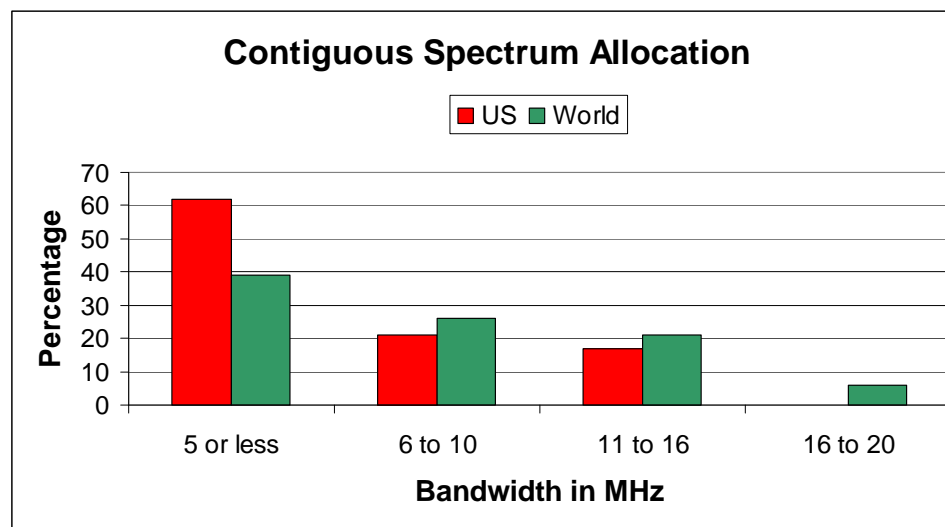› ITU
  – Spectrum, radio regulations

Standardization Process

Requirements

› What is the desired feature?
› General description

Architecture

› How to meet requirements
› Overall solution, building blocks, interfaces, etc

Detailed specifications

› All details, e.g., header format, coding and modulation, etc

Testing and verification

› Test cases from to ensure proper operation
› Basis for product development

Certification

Carrier Aggregation

› Fragmented spectrum
› Enable higher peak rates
› Simple concept
› Very tough RF problem

Contiguous Spectrum Allocation

Legend: ■ US ■ World

Chart — Percentage vs Bandwidth in MHz:
- 5 or less: US ≈ 62, World ≈ 39
- 6 to 10: US ≈ 21, World ≈ 26
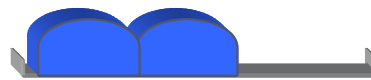- 11 to 16: US ≈ 17, World ≈ 21
- 16 to 20: World ≈ 6

Inter-band — band A, band B

Intra-band, contiguous carriers — band A, band B
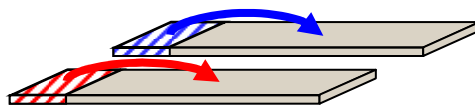
Intra-band, non-contiguous carriers — band A, band B

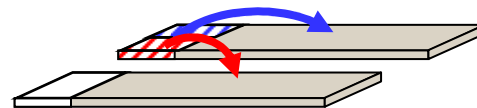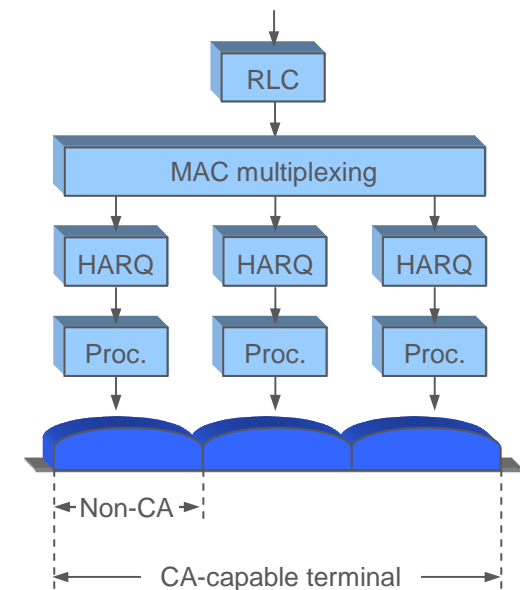# Baseband

> Control signaling per carrier

> PHY and ARQ per carrier

> Receiver baseband complexity proportional

> Scheme backward compatible

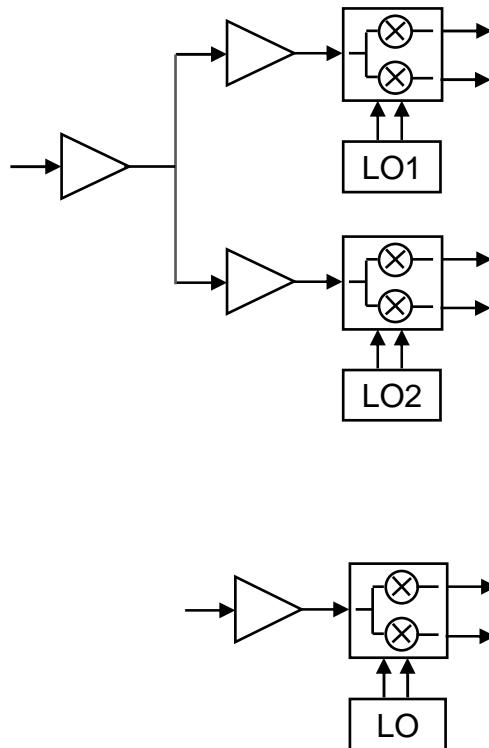> Optional scheduling across carriers

Normal case

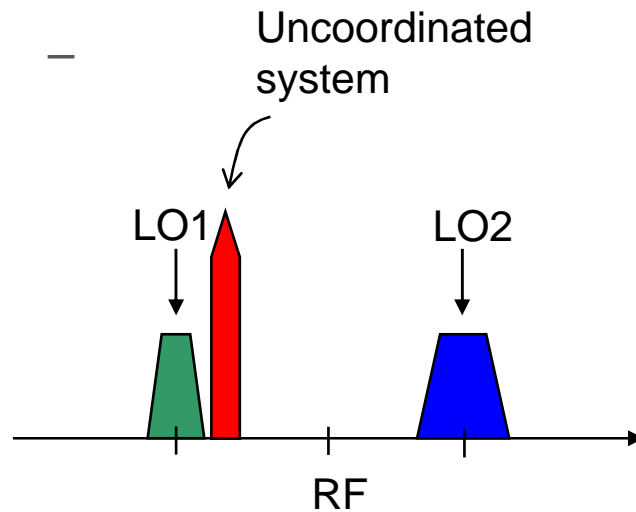Cross-carrier scheduling

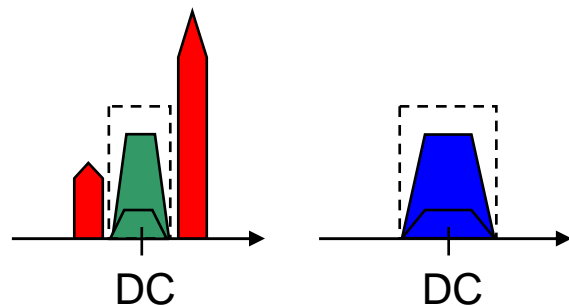# Intra-Band Non-Contiguous CA

band A

› Terminal receiver architectures

› Receivers equivalent in theory
› Different behavior with practical impairments
› Need detailed studies
  – Impairment simulation models
  – Imbalance, harmonics etc
› Performance spec
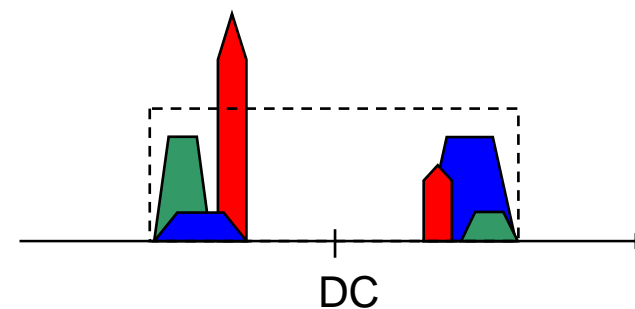 – Development can be completed
  – Products can be built, tested

I/Q Imbalance Impact

- Uncoordinated system

LO1 LO2

RF

DC DC DC

Dual branch Single branch

> Interference from uncoordinated system
>> – Image interference
>> – Different effect
> Discussions among companies
> Internal discussions
>> – Research, development, product
>> – Risk, cost, current, size

Standards Process

› Ideas get vetted
  – 2+ years from initial study item to finished spec
  – Feature has to address some need
  – Participants shape feature along the way
    › Vendors, operators with vested interests
    › Mix of collaboration and competition
  – Account for realistic technology capabilities
› Finished spec
  – Useful
  – Practical
  – Developed
  – Deployed

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