



TÉCNICO
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A Brief History of Actions on Mobile and Wireless Communications

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Outline

- Evolution of mobile cellular communications.
- COST Actions on mobile and wireless communications.
- Statistics and speculation.

Evolution of Mobile Cellular Systems

- Mobile cellular systems generations present a 10 years cycle.

System	Start	Count.	Band [MHz]	Channel [kHz]
NMT	1981	NO, SE	450, 900	25
C	1985	DE	450	20
...
GSM	1991	EU	900, 1 800	200
D-AMPS	1991	US	800	30
PDC	1995	JP	900, 1 500	25
cdmaOne	1996	US	1 800	1 250
UMTS	2002	EU, JP	2 000	5 000
cdma2000	2003	US	1 900	1 250
LTE	2010	SE, NO	800, 2 600	≤ 20 000
NR	2019	KR, US	700, 3 600	≤ 100 000

Evolution of Mobile Phones

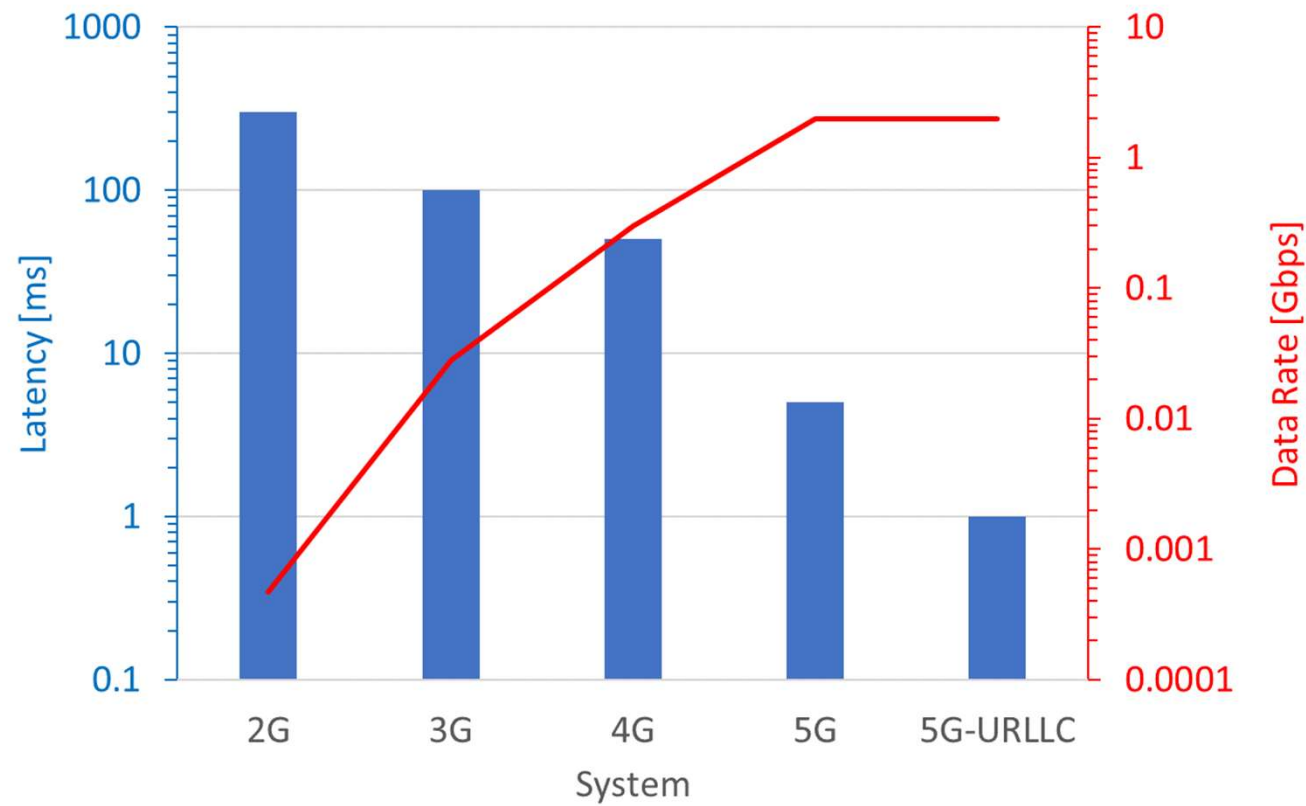
- Mobile phones have evolved enormously.



[Source: BigCircle, 2012]

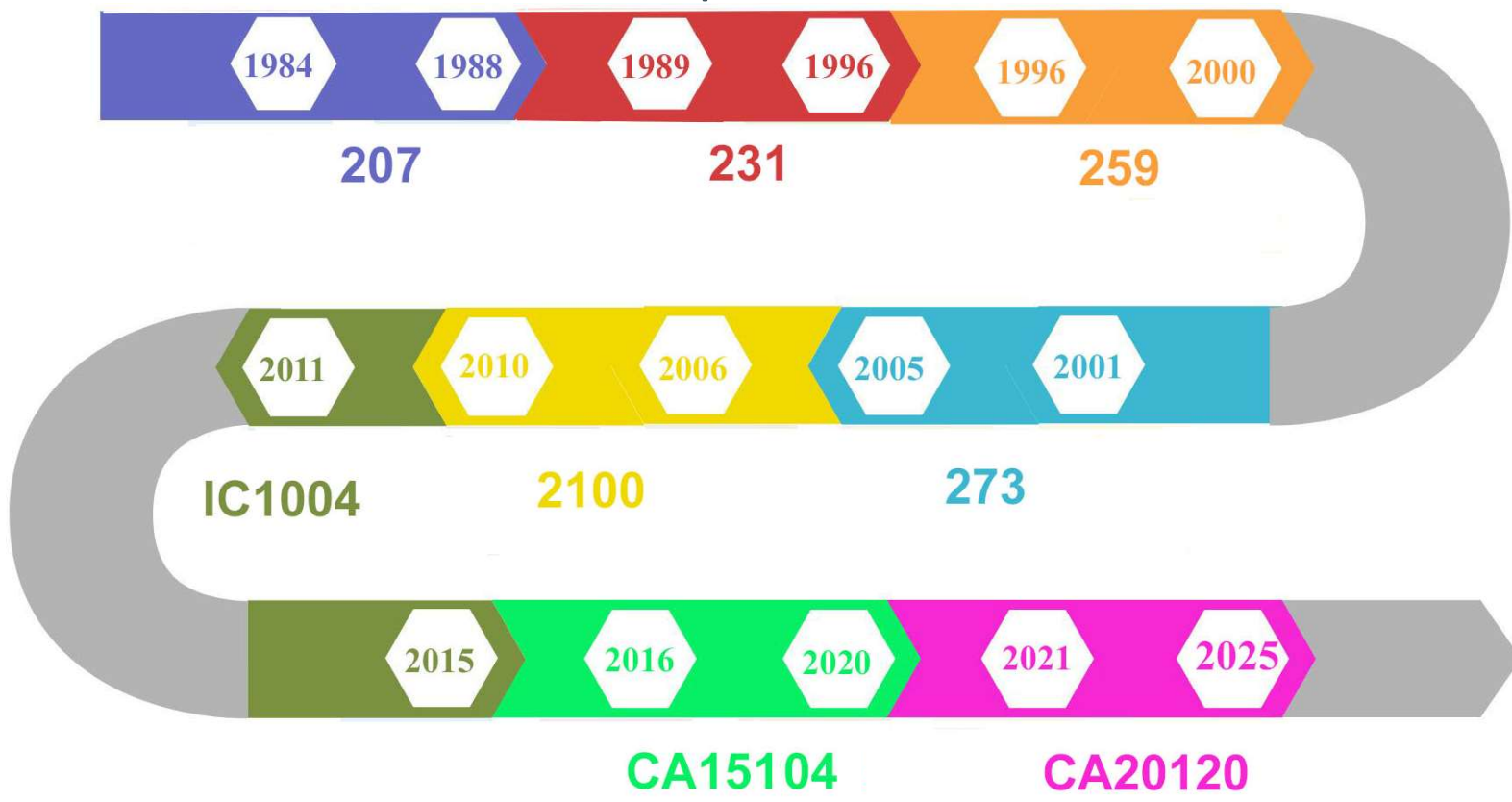
Evolution of Users' Experience

- Users have witnessed a real improvement in data usage metrics.



The Actions' Timeline

- **207** started in 1984 and follow-up Actions have succeeded since then.



COST 207

- 1984 Mar. / 1988 Sep.
- Digital Land Mobile Radio Communications.



COST 207 (phone)

- Which phone at the time:
 - analogue system (1G);
 - just the voice service;
 - very expensive phone;
 - very heavy phone.



COST 207 MoU (1)

- MoU (1984-Mar-18):
 - *“Public and private land mobile radio systems are experiencing a very rapid expansion with an increasing degree of sophistication in most countries.”*
 - *“The possibility of using one system throughout Europe and the advantages to both the manufactures and subscribers of a larger scale market have already led the CEPT to establish the 'mobile special group' (GSM) with the task of producing guidelines and specifications for a harmonized European public mobile communications system”.*

COST 207 MoU (2)

- *“In this context it appears that the COST framework is particularly suitable to coordinate research activities on well defined subjects to produce results of direct use for the envisaged European system.”*
- *“It is not yet possible to state whether the GSM system will have digital or analogue speech transmission, but it is practically certain that the signalling will be on a digital basis.”*
- *“Consequently, considering that knowledge of analogue transmission is well advanced, COST activities should concentrate on digital aspects.”*

COST 207 (book)

- The result:
 - COST **207** channel models for GSM radio interface, and many others;
 - a book as Final Report.



COST 231

- 1989 Apr. / 1996 Apr.
- Evolution of Land Mobile Radio (Including Personal) Communications.



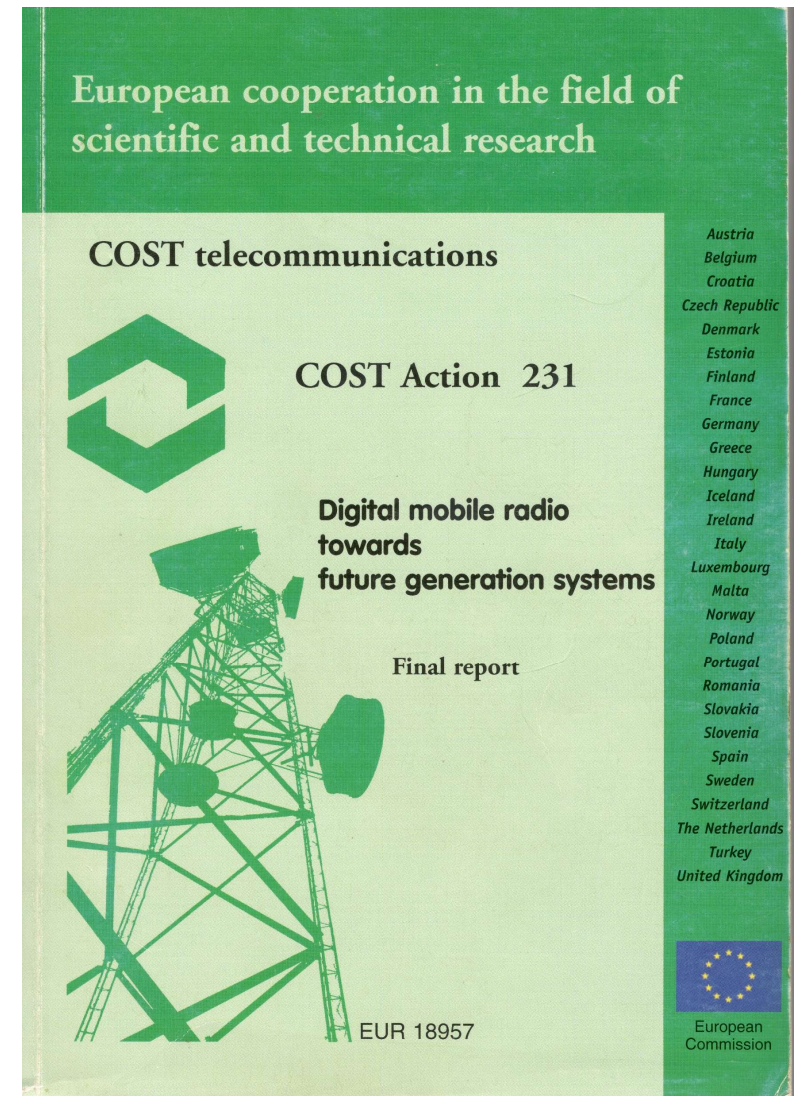
COST 231 (phone)

- Which phone at the time:
 - digital system (2G);
 - voice and message services;
 - still expensive phone;
 - still heavy phone.



COST 231 (book)

- The result:
 - COST 231 path loss models, and many others;
 - a book as Final Report.



COST 259

- 1996 Dec. / 2000 Apr.
- Wireless Flexible Personalised Communications.



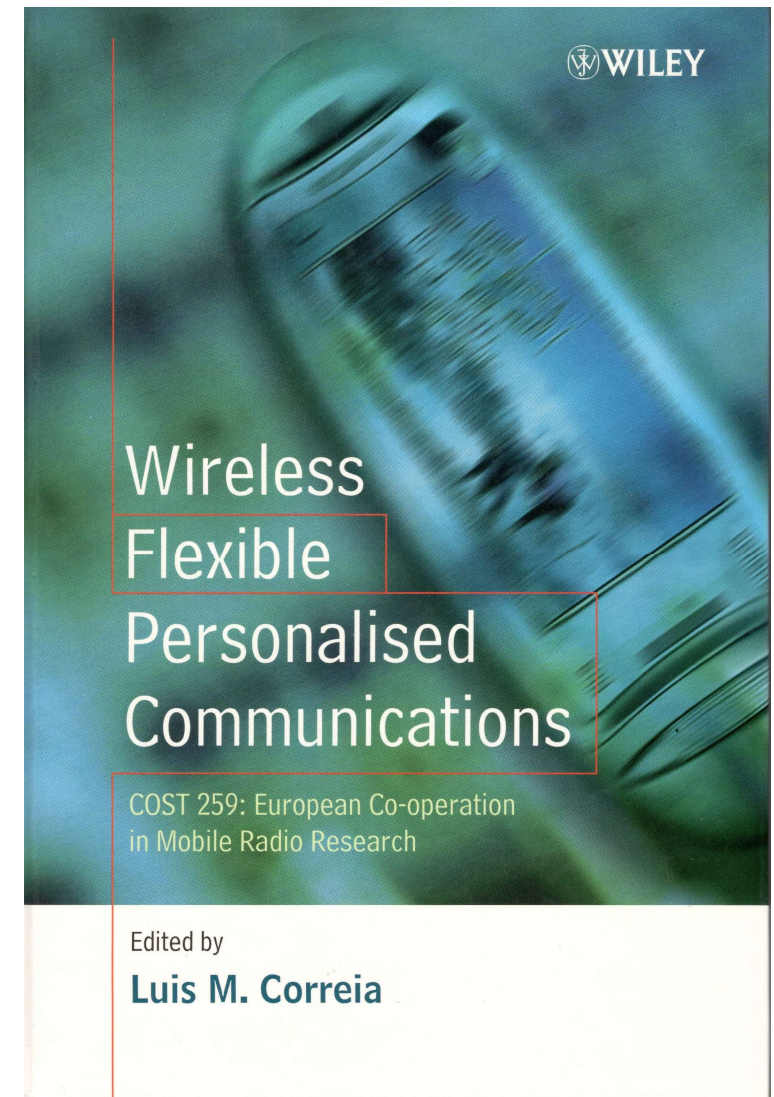
COST 259 (phone)

- Which phone at the time:
 - still 2G;
 - beginning of data (Internet) services, at ~50 kbps.



COST 259 (book)

- The result:
 - COST 259 spatial channel models, and many others;
 - a book as Final Report.



COST 273

- 2001 May / 2005 Jun.
- Towards Mobile Broadband Multimedia Communications.



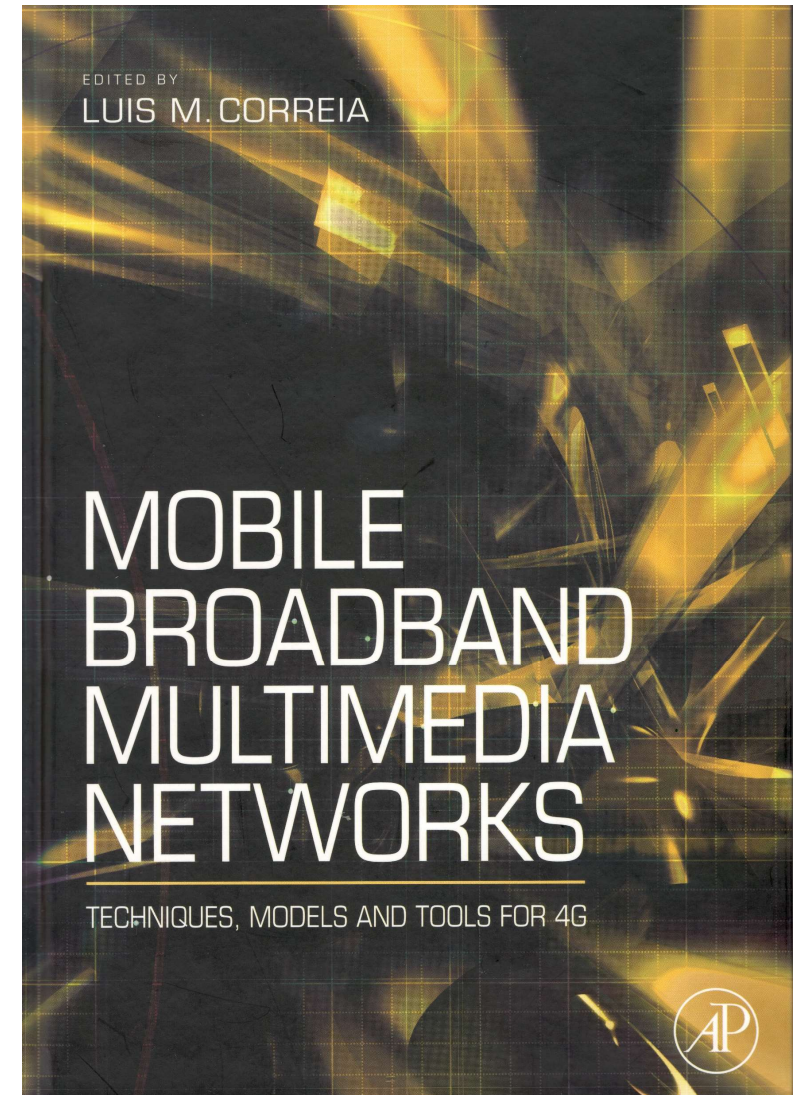
COST 273 (phone)

- Which phone at the time:
 - 3G;
 - data (Internet) services, at 2 Mbps.



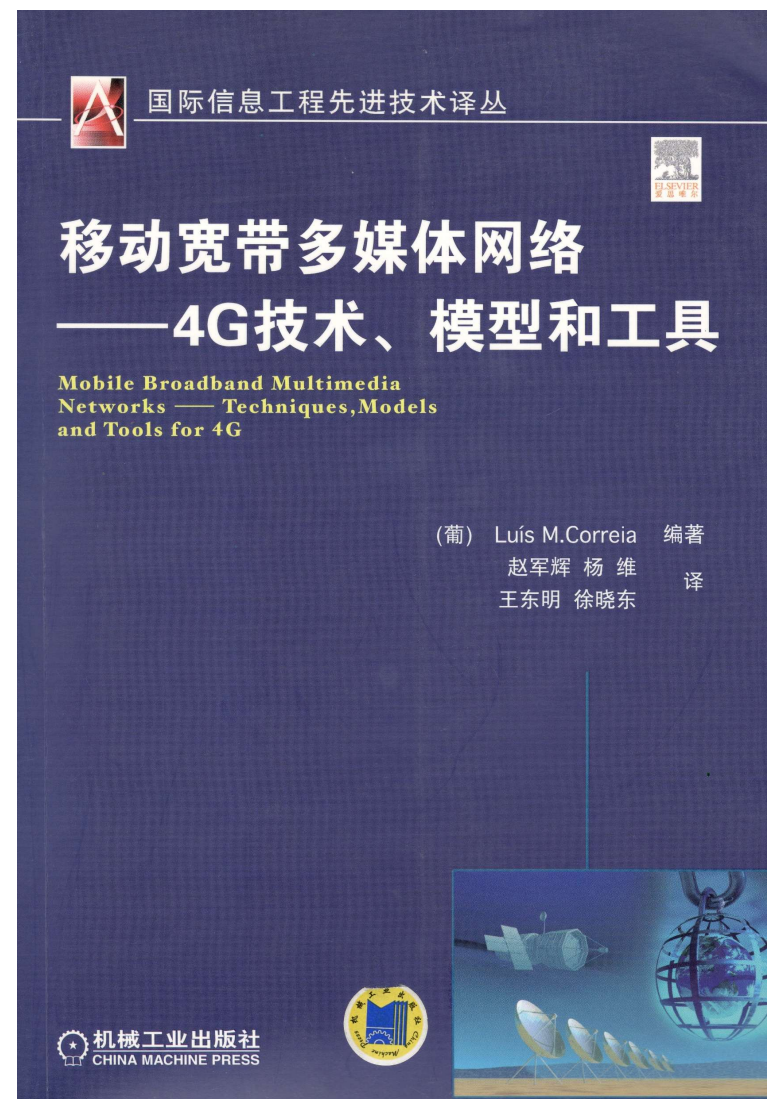
COST 273 (book) (1)

- The result:
 - COST **273** MIMO (Multiple Input Multiple Output) channel models, and many others;
 - a book as Final Report.



COST 273 (book) (2)

- The Final Report was translated into Chinese.



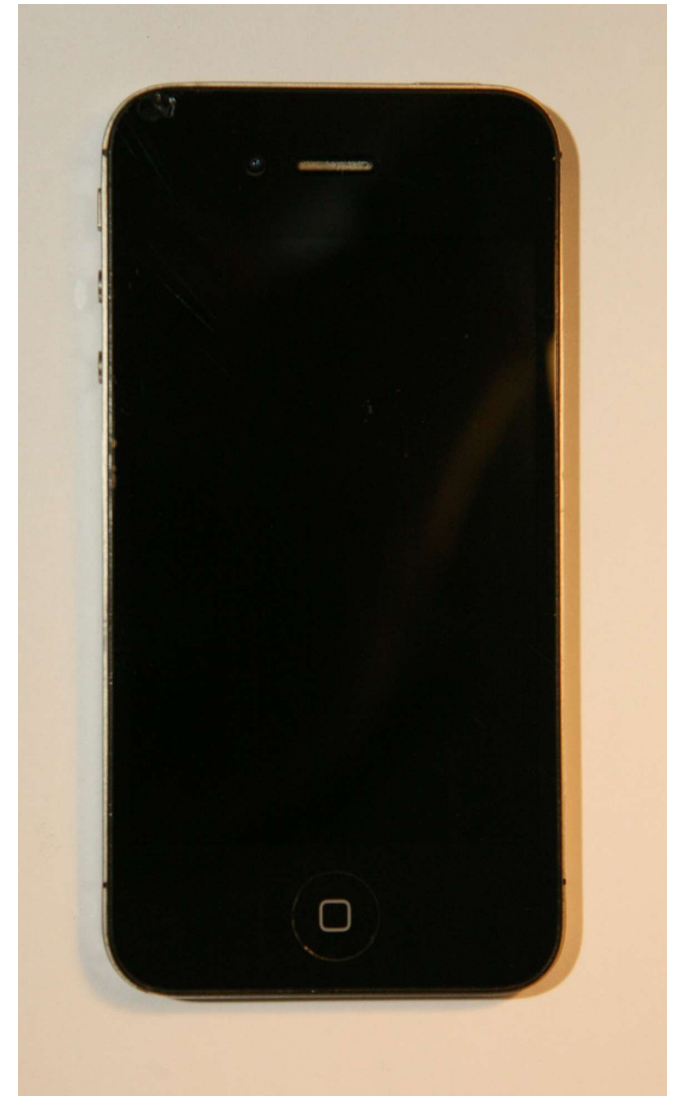
COST 2100

- 2006 Dec. / 2010 Dec.
- Pervasive Mobile & Ambient Wireless Communications.



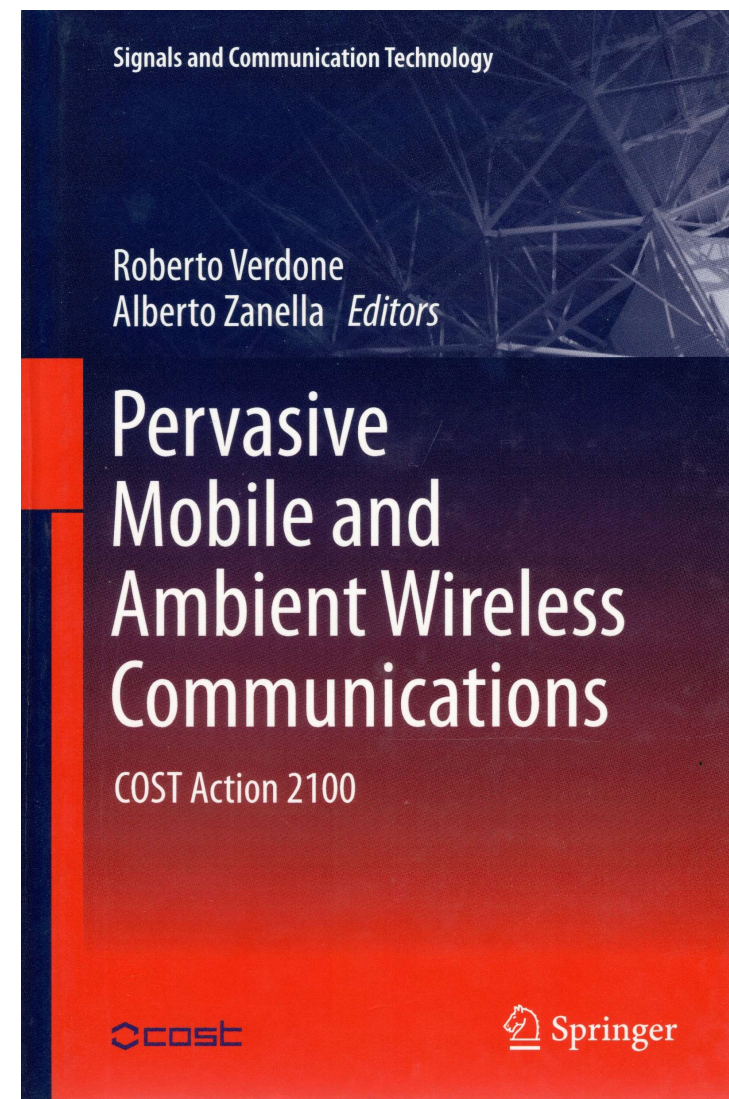
COST 2100 (phone)

- Which phone at the time:
 - still 3G (but, the iPhone!);
 - data (Internet) services, at 20 Mbps;
 - the dawn of the apps.



COST 2100 (book)

- The result:
 - COST **2100** OTA (Over-the-Air) testing models, and many others;
 - a book as Final Report.



COST IC1004

- 2011 May / 2015 May
- Cooperative Radio Communications for Green Smart Environments.



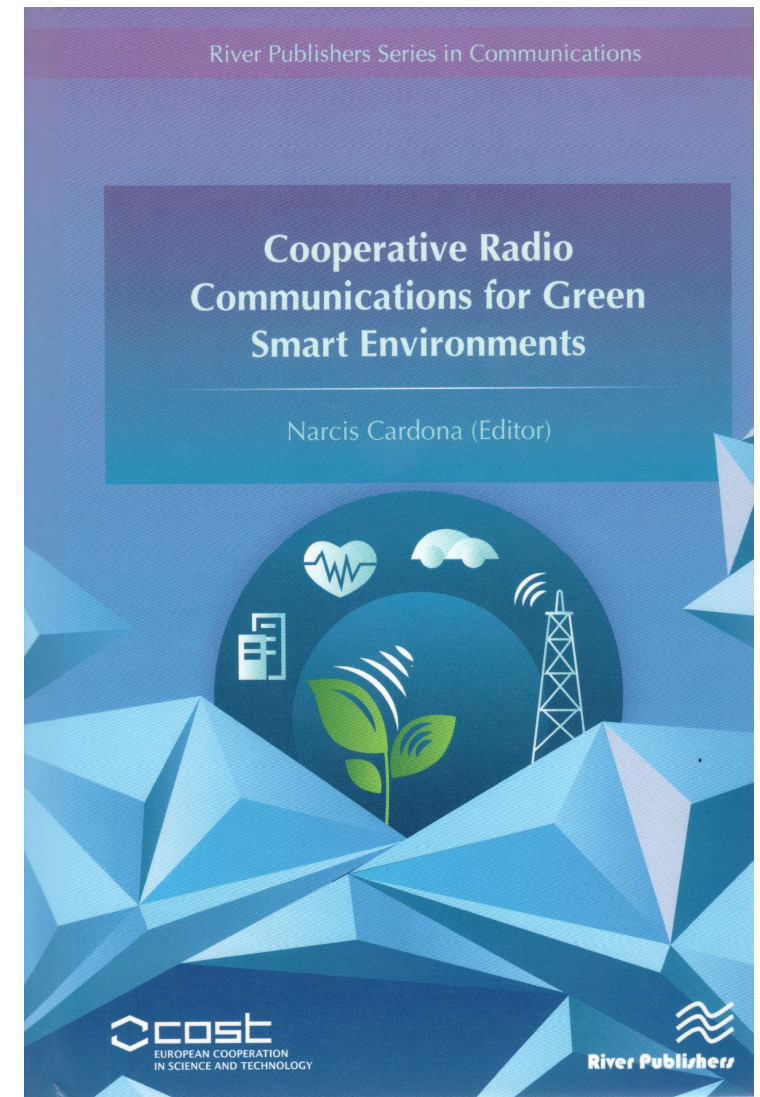
COST IC1004 (phone)

- Which phone at the time:
 - 4G;
 - data services, at 50 Mbps;
 - the dawn of video.



COST IC1004 (book)

- The result:
 - COST **IC1004** MIMO OTA testing methods, and many others;
 - a book as Final Report.



COST CA15104 IRACON

- 2016 Mar. / 2020 Mar.
- Inclusive Radio Communication Networks for 5G and Beyond.



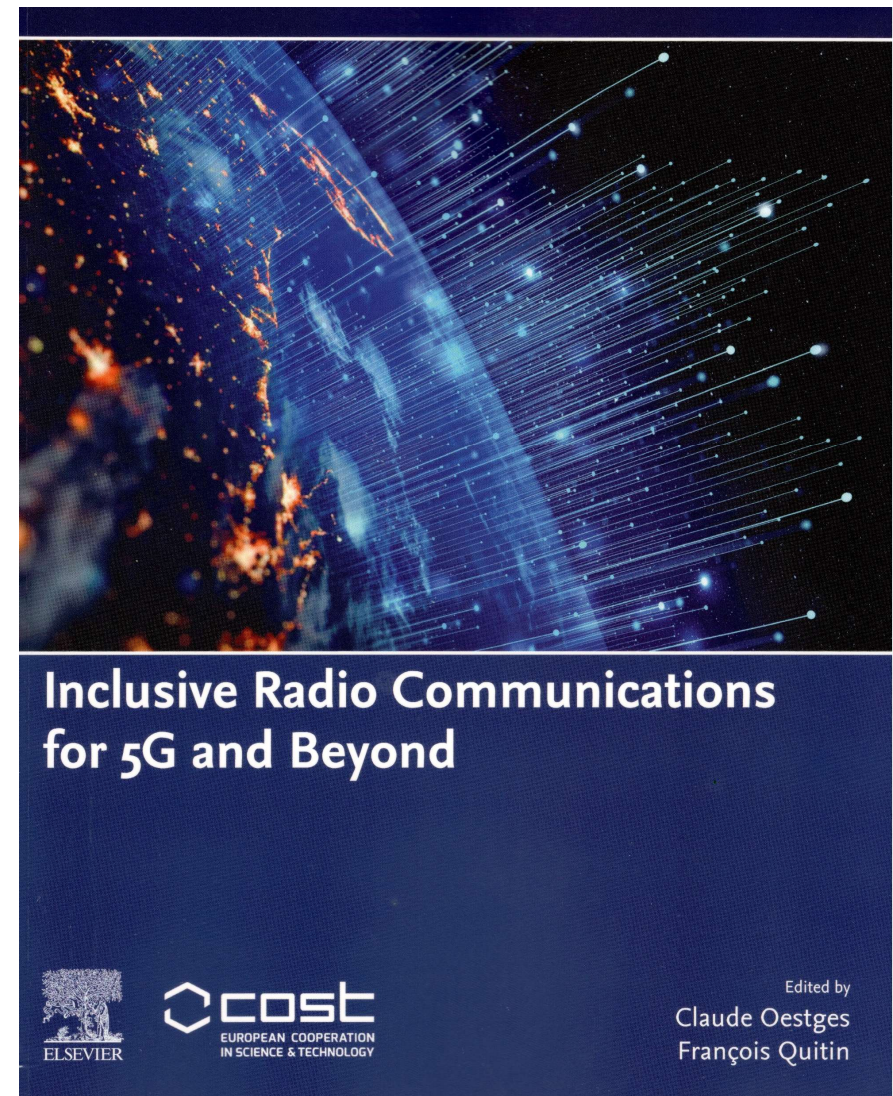
COST CA15104 (phone)

- Which phone at the time:
 - still 4G;
 - data services, at 150 Mbps;
 - the reign of video.



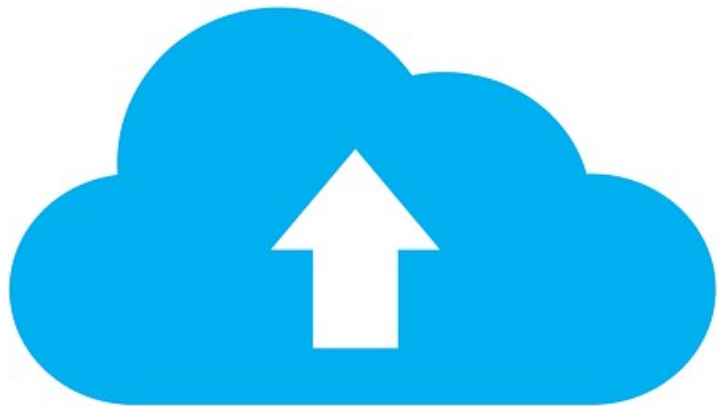
COST CA15104 (book)

- The result:
 - COST **CA15104** channel models for mm waves and THz bands, and many others;
 - a book as Final Report.



COST CA20120 INTERACT

- 2021 Sep. / 2025 Sep.
- Intelligence-Enabling Radio Communications for Seamless Inclusive Interactions.



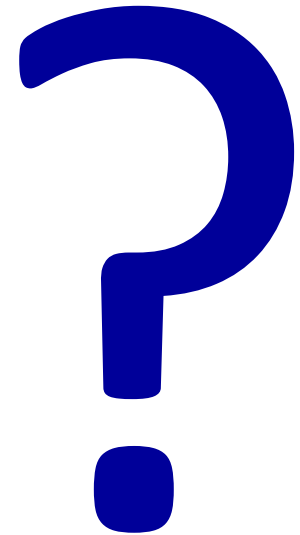
COST CA20120 (phone)

- Which phone at the time:
 - 5G glasses;
 - data services, at 1 Gbps;
 - the dawn of XR (eXtended Reality).



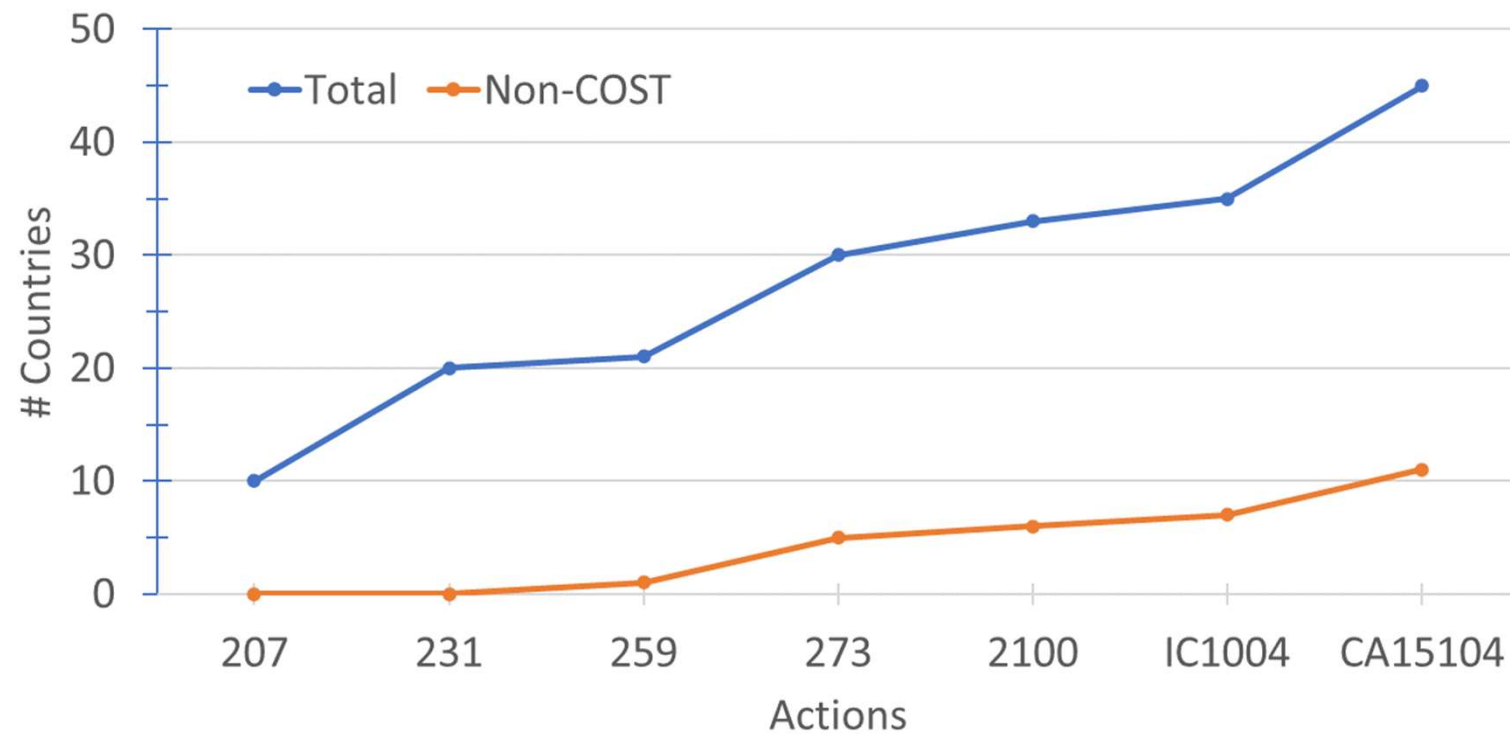
COST CA20120 (book)

- The result:
 - COST CA20120 ??? model!?
 - a book as Final Report!?



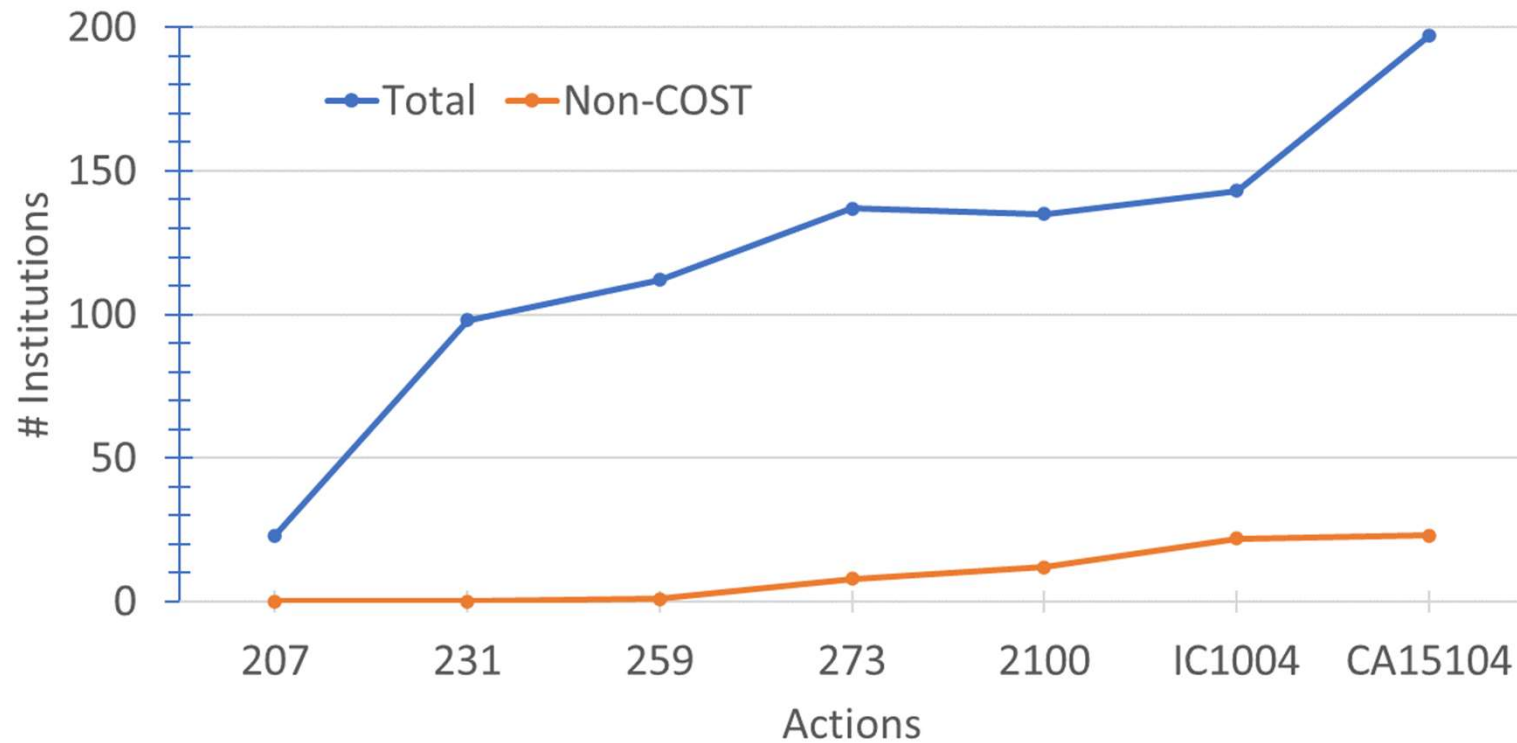
Participating Countries

- The number of participating countries has increased.



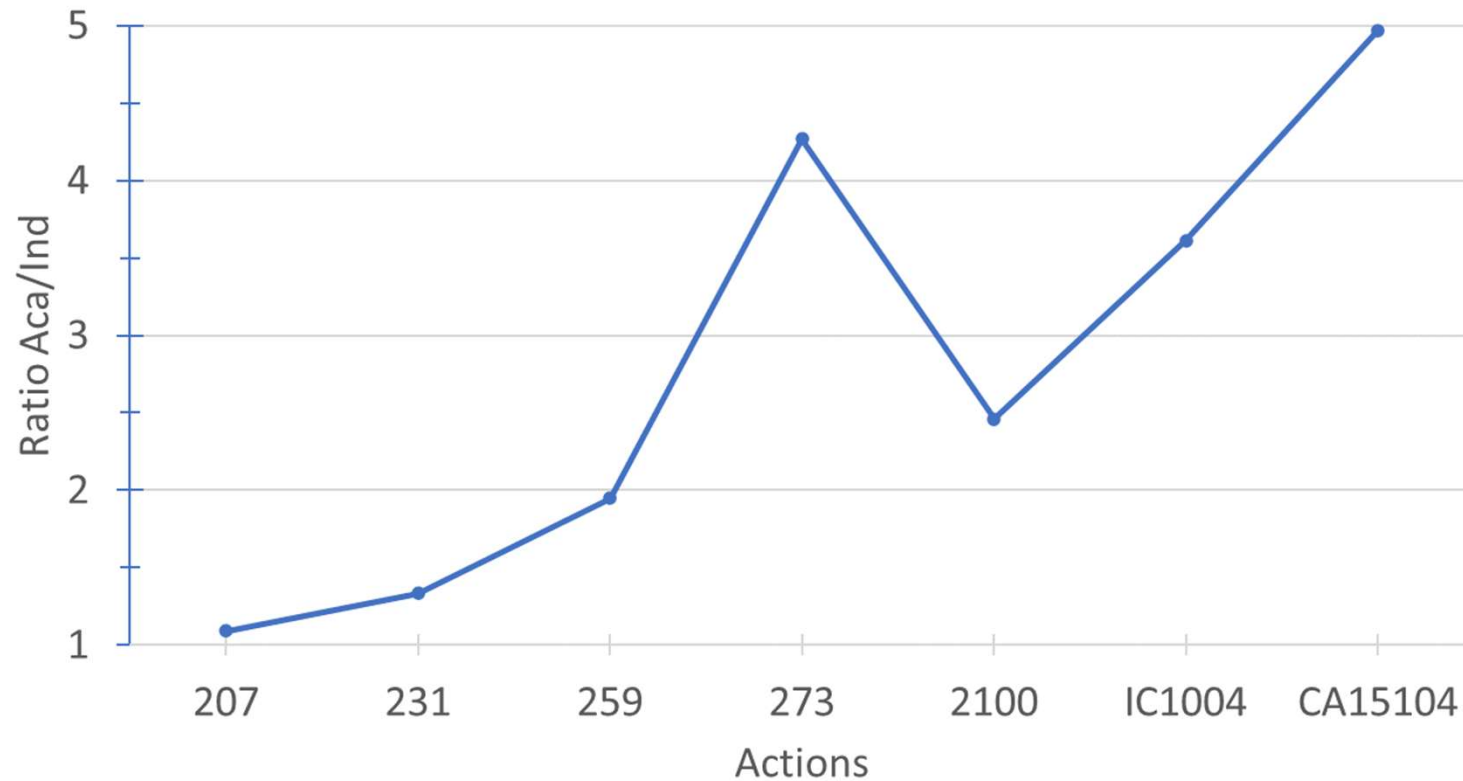
Participating Institutions

- The number of participating institutions has also increased.



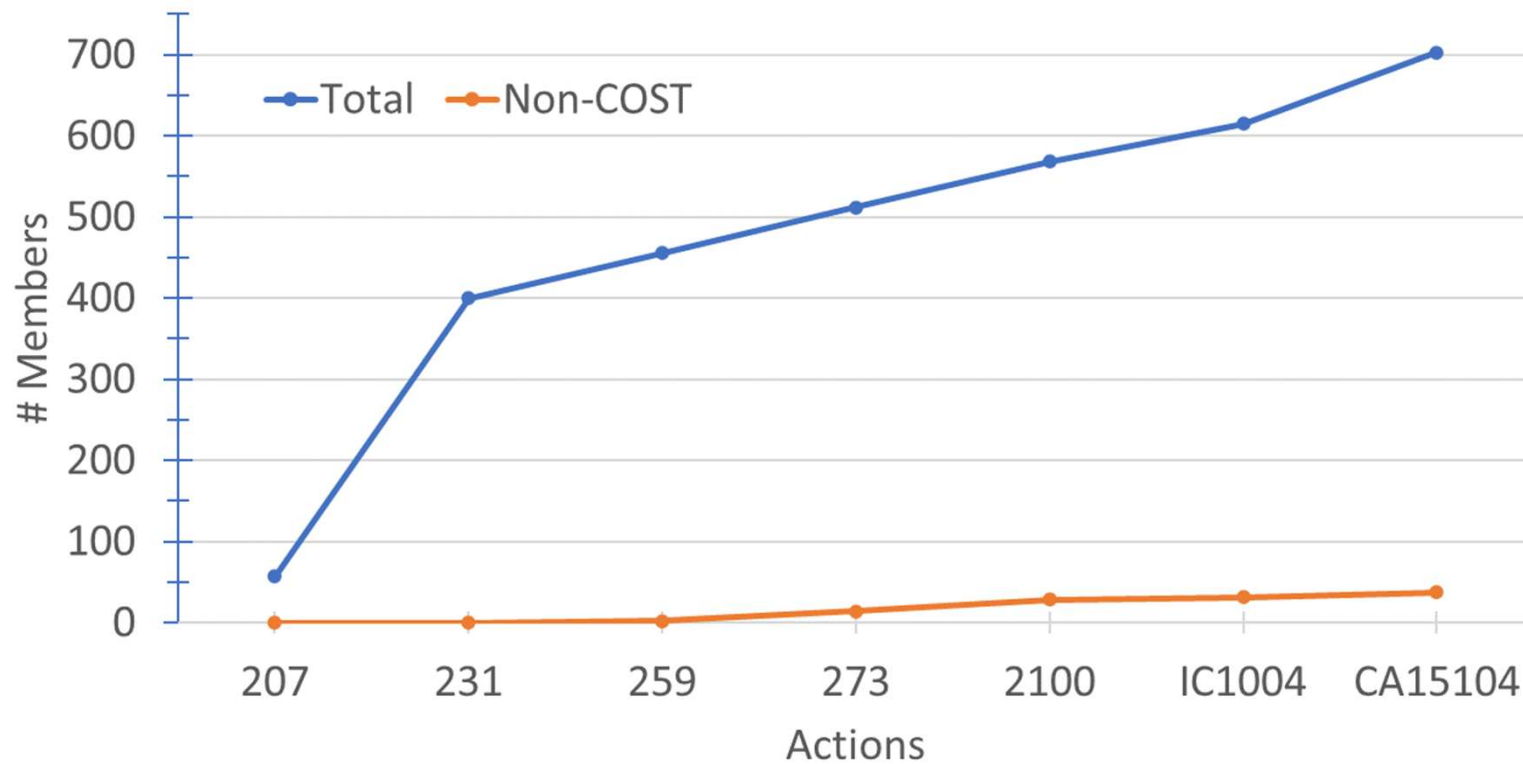
Academia vs. Industry Participation

- The participation of industry has strongly changed along the years.



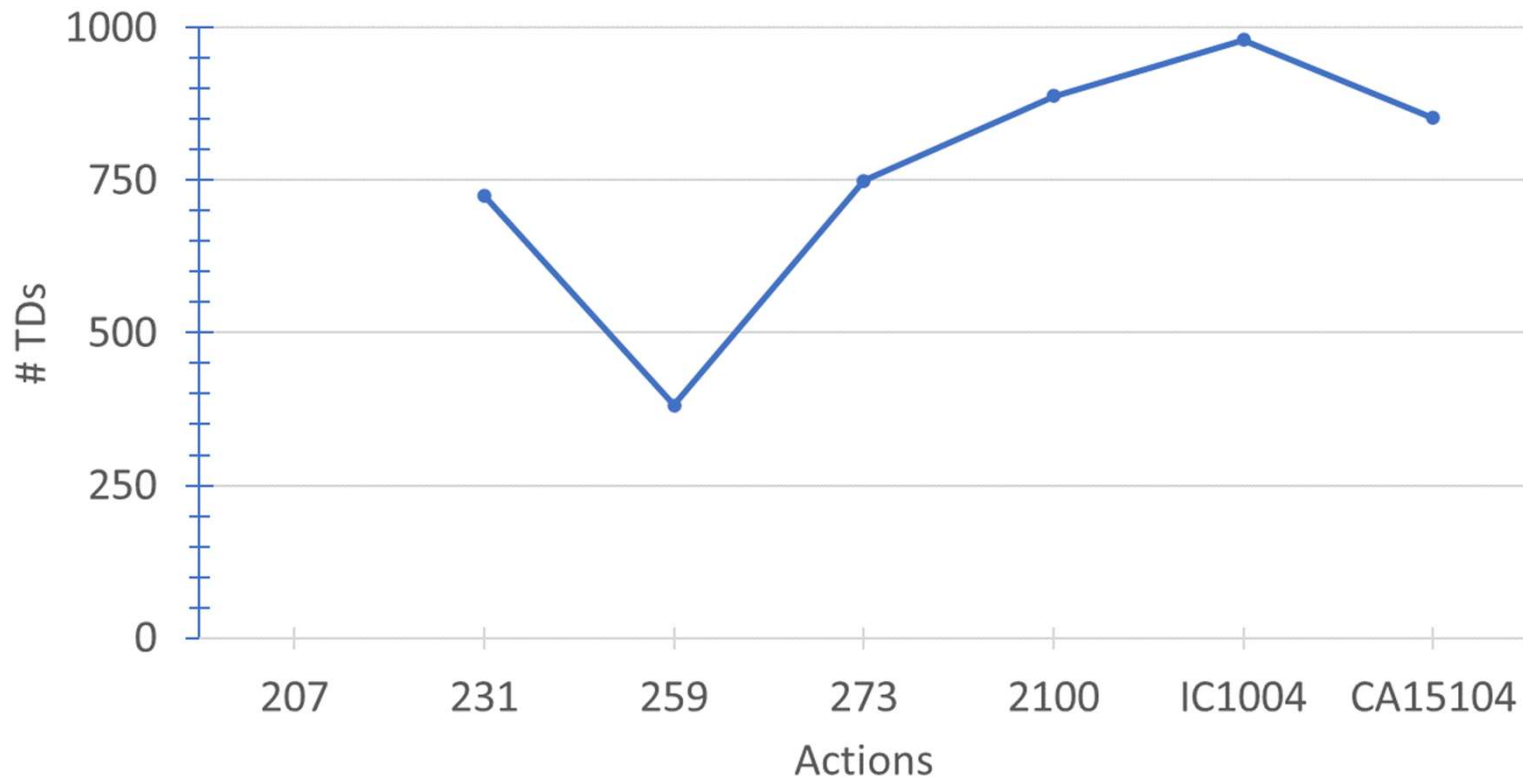
Participating Researchers

- The number of participating researchers has increased as well.



Technical Documents

- The number of discussed TDs shows the amount of work developed.

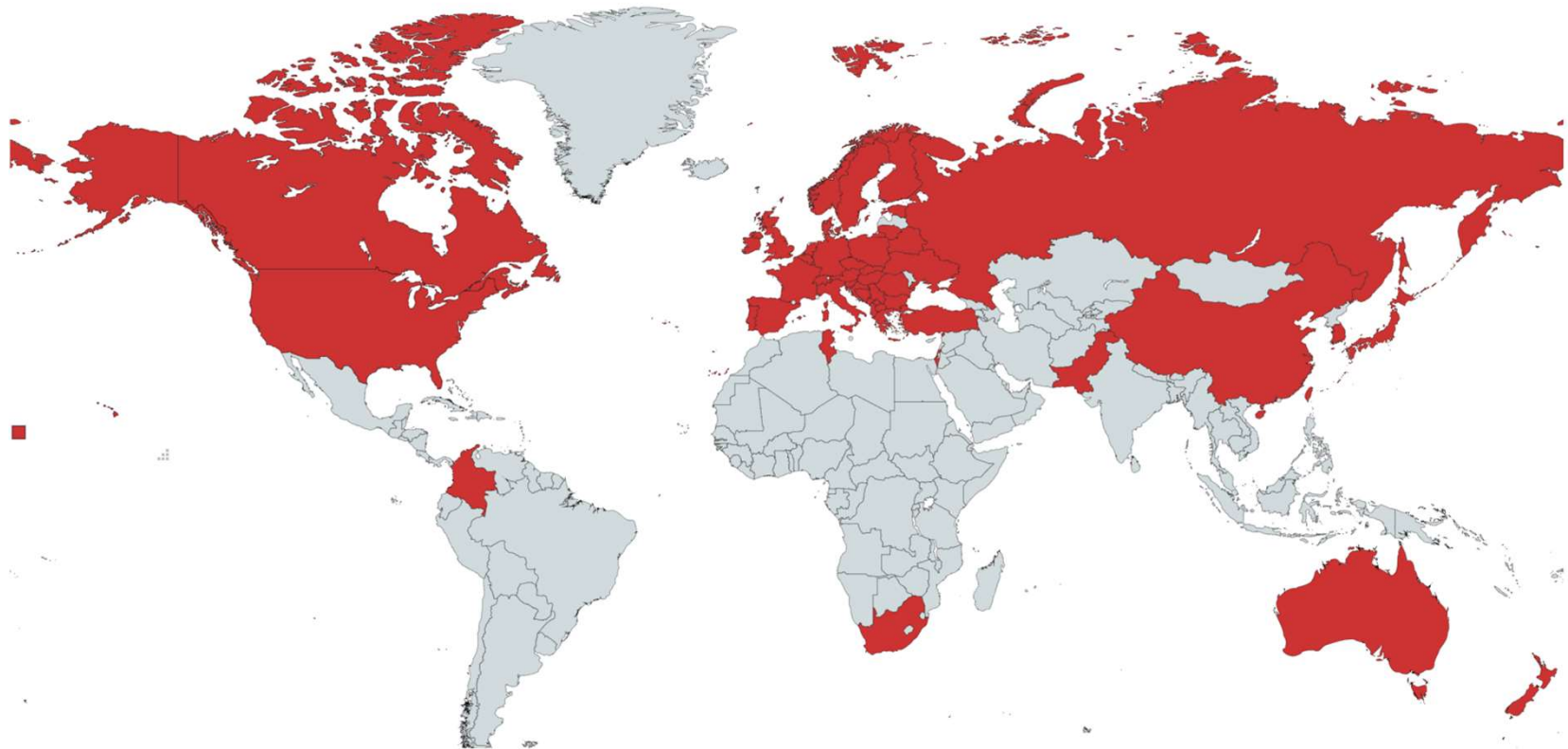


Speculation

- Cumulatively, Actions have fostered:
 - ~10s EC framework projects;
 - ~100s research projects;
 - ~1 000s joint papers;
 - ~10 000s research collaborations.

World Reach

- Cumulatively, Actions have reached researchers from around the world.



Conclusions

- The COST Programme is one of the most successful European inventions.
- COST Actions established a large community of researchers in the area of mobile and wireless communications all around the world.
- COST Actions have contributed to the development of mobile and wireless communications.
- Hopefully, this is not the end of the story.

The End

- *“I think there is a world market for maybe 5 computers”, Thomas Watson (IBM), 1943.*
- *“There is no reason anyone would want a computer in their home”, Keneth Olsen (DEC), 1977.*
- *“The best way to predict the future is to invent it”, Alan Kay (UCLA), 1971.*

Thank You!

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