

# On the Impact of the SDL Forum Society Conferences on Academic Research

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SDL Forum 2017  
Budapest, Hungary

# About the SDL Forum Society

- Established in 1996 as a not-for-profit organization but has existed informally since June 1990.
- Many researchers and practitioners from academic and industrial organizations around the world have contributed to the Society's success over the years.
- Many Society members have led the standardization and revisions of ITU-T languages.
- The Society has created a community of academic and industrial experts that shared their experiences using languages and their supporting tools.
- The Society plans and organizes two conferences every year: SDL Forum and SAM.

# Objective of the Study

To perform a citation analysis of the papers published in SDL/SAM proceedings published between 1991 and 2016 in order to assess the impact of these events on academic research.

# Research Questions

- RQ1. Which *papers* published at events organized by the Society have the highest academic impact?
- RQ2. Which *authors* of papers published at events organized by the Society had the highest academic impact and the largest number of contributions?
- RQ3. What are the *topics* and system design *languages* explored in the Society's papers?

# Methodology

- The methodology for RQ1 and RQ2:
  - Selecting the relevant event proceedings
  - Selecting the relevant papers
  - Collecting citation counts
  - Computing relevant metrics
- For RQ3, we examine the titles and keywords of the paper to identify common languages and topics discussed in the publications

# Selected Proceedings

Year	SDL/SAM	Title	Editors	Location
1991	5th SDL	Evolving Methods	O. Færgemand, R. Reed	Glasgow, Scotland
1993	6th SDL	Using Objects	O. Færgemand, A. Sarma	Darmstadt, Germany
1995	7th SDL	With MSC in CASE	R. Bræk, A. Sarma	Trondheim, Norway
1997	8th SDL	Time for Testing, SDL, MSC and Trends	A.R. Cavalli, A. Sarma	Evry, France
1999	9th SDL	The Next Millennium	R. Dssouli, G. von Bochmann, Y. Lahav	Montréal, Canada
2000	2nd SAM	SDL and MSC	E. Sherratt	Grenoble, France
2001	10th SDL	Meeting UML	R. Reed, J. Reed	Copenhagen, Denmark
2002	3rd SAM	Telecommunications and beyond: The Broader Applicability of SDL and MSC	E. Sherratt	Aberystwyth, Wales
2003	11th SDL	System Design	R. Reed, J. Reed	Stuttgart, Germany
2004	4th SAM	System Analysis and Modeling	D. Amyot, A.W. Williams	Ottawa, Canada
2005	12th SDL	Model Driven	A. Prinz, R. Reed, J. Reed	Grimstad, Norway
2006	5th SAM	Language Profiles	R. Gotzhein, R. Reed	Kaiserslautern, Germany
2007	13th SDL	Design for Dependable Systems	E. Gaudin, E. Najm, R. Reed	Paris, France
2009	14th SDL	Design for Motes and Mobiles	R. Reed, A. Bilgic, R. Gotzhein	Bochum, Germany
2010	6th SAM	About Models	F.A. Kraemer, P. Herrmann	Oslo, Norway
2011	15th SDL	Integrating System and Software Modeling	I. Ober, I. Ober	Toulouse, France
2012	7th SAM	Theory and Practice	Ø. Haugen, R. Reed, R. Gotzhein	Innsbruck, Austria
2013	16th SDL	Model-Driven Dependability Engineering	F. Khendek, M. Toeroe, A. Gherbi, R. Reed	Montréal, Canada
2014	8th SAM	Models and Reusability	D. Amyot, P. Fonseca i Casas, G. Mussbacher	Valencia, Spain
2015	17th SDL	Model-Driven Engineering for Smart Cities	J. Fischer, M. Scheidgen, I. Schieferdecker, R. Reed	Berlin, Germany
2016	9th SAM	Technology-Specific Aspects of Models	J. Grabowski, S. Herbold	Saint-Malo, France

# Paper Selection Process

- This study focuses on scientific and industrial contributions.
  - Short papers such as prefaces and extended abstracts were excluded from the dataset.
- Authors' names were cleaned up by removing all dots, dashes, and extra spaces.
- **Number of papers: 464**
- **Number of distinct authors: 765**

# Collection of Citation Counts



**1991 - 2016**



**2001 - 2016**



**1991 - 1999**



# Computation of Metrics

- For each paper, we have **two citation counts**:
  - One from Google Scholar,
  - Another one from Scopus (2001-2016) or WoS (1991-1999).
- Having two sources allows us to reason about each individually, but also in combination.
- Some of our metrics use a **combined count** for each paper that is the sum of the two basic counts.

# RQ1. Most influential papers

Authors	Title	Year	Combined	Combined Rank	Scholar	Scholar Rank	Combined/Year	Combined/Year Rank
Mauw S, Reniers MA	High-level Message Sequence Charts	1997	145	<b>1</b>	137	<b>1</b>	7.25	<b>6</b>
Eichner C, Fleischhack H, Meyer R, et al.	Compositional semantics for UML 2.0 sequence diagrams using Petri nets	2005	124	<b>2</b>	84	<b>5</b>	10.33	<b>1</b>
Grabowski J, Hogrefe D, Nahm R	Test Case Generation with Test Purpose Specification by MSCs	1993	110	<b>3</b>	110	<b>2</b>	4.58	17
Graubmann P, Rudolph E, Grabowski J	Towards a Petri Net Based Semantics Definition for Message Sequence Charts	1993	109	<b>4</b>	109	<b>3</b>	4.54	18
Amyot D, Farah H, Roy JF	Evaluation of development tools for domain-specific modeling languages	2006	94	<b>5</b>	69	<b>7</b>	8.55	<b>3</b>
Bozga M, Fernandez JC, Ghirvu L, Graf S, et al.	IF: An intermediate representation for SDL and its applications	1999	90	<b>6</b>	87	<b>4</b>	5.00	<b>12</b>
Amyot D, Mussbacher G	URN: Towards a new standard for the visual description of requirements	2002	87	<b>7</b>	68	<b>8</b>	5.80	<b>9</b>
Kerbrat A, Jeron T, Groz R	Automated test generation from SDL specifications	1999	84	<b>8</b>	78	<b>6</b>	4.67	16
Roy JF, Kealey J, Amyot D	Towards integrated tool support for the User Requirements Notation	2006	81	<b>9</b>	60	<b>11</b>	7.36	<b>4</b>
Baker P, Bristow P, Jervis C, King D, et al.	Automatic generation of conformance tests from message sequence charts	2002	80	<b>10</b>	63	<b>10</b>	5.33	<b>11</b>
Miga A, Amyot D, Bordeleau F, et al.	Deriving message sequence charts from use case maps scenario specifications	2001	69	<b>11</b>	52	<b>13</b>	4.31	22
Algayres B, Lejeune Y, Hugonnet F	GOAL: Observing SDL behaviors with GEODE	1995	66	<b>12</b>	66	<b>9</b>	3.00	40
Bozga M, Graf S, Mounier L, et al.	Timed extensions for SDL	2001	63	<b>13</b>	50	<b>14</b>	3.94	30
Haugen Ø	Comparing UML 2.0 interactions and MSC-2000	2004	56	<b>14</b>	47	16	4.31	23
Mauw S, van Wijk M, Winter T	A Formal semantics of Synchronous Interworkings	1993	55	<b>15</b>	55	<b>12</b>	2.29	60
Mansurov N, Zhukov D	Automatic synthesis of SDL models in use case methodology	1999	53	16	50	<b>14</b>	2.94	46
Kraemer FA, Bræk R, Herrmann P	Synthesizing components with sessions from collaboration-oriented service specifications	2007	48	19	36	23	4.80	<b>15</b>
Lúcio L, Mustafiz S, Denil J, et al.	FTG+PM: An integrated framework for investigating model transformation chains	2013	37	29	21	53	9.25	<b>2</b>
Genon N, Amyot D, Heymans P	Analysing the cognitive effectiveness of the UCM visual notation	2010	35	35	23	48	5.00	<b>12</b>
Fleurey F, Haugen Ø, Møller-Pedersen B et al.	Standardizing variability - Challenges and solutions	2011	29	51	17	72	4.83	<b>14</b>
Denil J, Jukss M, Verbrugge C, et al.	Search-based model optimization using model transformations	2014	22	73	16	77	7.33	<b>5</b>
Hackenberg G, Campetelli A, et al.	Formal technical process specification and verification for automated production systems	2014	19	89	12	112	6.33	<b>7</b>
Haugen Ø, Øgård O	BVR – better variability results	2014	18	96	12	112	6.00	<b>8</b>
Duran MB, Mussbacher G, et al.	On the reuse of goal models	2015	11	156	8	160	5.50	<b>10</b>

# RQ1. Most cited papers (excluding 2016)

Year	Authors	Title	Scopus / WoS	Scholar	Combined
2015	Duran MB, Mussbacher G, Thimmegowda N, Kienzle J	On the reuse of goal models	3	8	11
2014	Denil J, Jukss M, Verbrugge C, Vangheluwe H	Search-based model optimization using model transformations	6	16	22
2013	Lúcio L, Mustafiz S, Denil J, Vangheluwe H, Jukss M	FTG+PM: An integrated framework for investigating model transformation chains	16	21	37
2012	Schneider M, Großmann J, Tcholtehev N, <i>et al.</i>	Behavioral fuzzing operators for UML sequence diagrams	8	13	21
2011	Perrotin M, Conquet E, Delange J, Schiele A, Tsiodras T	TASTE: A real-time software engineering tool-chain overview, status, and future	6	20	26
2011	Fleurey F, Haugen Ø, MøllerPedersen B, <i>et al.</i>	Standardizing variability - Challenges and solutions	12	17	29
2010	Genon N, Amyot D, Heymans P	Analysing the cognitive effectiveness of the UCM visual notation	12	23	35
2009	Mussbacher G, Amyot D	Extending the User Requirements Notation with aspect-oriented concepts	12	20	32
2007	Kraemer FA, Bræk R, Herrmann P	Synthesizing components with sessions from collaboration-oriented service specifications	12	36	48
2006	Amyot D, Farah H, Roy JF	Evaluation of development tools for domain-specific modeling languages	25	69	94
2005	Eichner C, Fleischhack H, Meyer R, Schrimpf U, Stehno C	Compositional semantics for UML 2.0 sequence diagrams using Petri nets	40	84	124
2004	Haugen Ø	Comparing UML 2.0 interactions and MSC-2000	9	47	56
2003	Petriu D, Amyot D, Woodside M	Scenario-based performance engineering with UCMNAV	9	25	34
2003	He Y, Amyot D, Williams AW	Synthesizing SDL from use case maps: An experiment	11	23	34
2002	Amyot D, Mussbacher G	URN: Towards a new standard for the visual description of requirements	19	68	87
2001	Miga A, Amyot D, Bordeleau F, Cameron D, Woodside M	Deriving message sequence charts from use case maps scenario specifications	17	52	69
2000	Hélouët L, Le Maigat P	Decomposition of Message Sequence Charts	0	38	38
2000	Bozga M, Graf S, Kerbrat A, Mounier L, Ober I, Vincent D	SDL for real time: What is missing ?	0	37	37
2000	Schmitt M, Grabowski J, Ebner M	Test Generation with Autolink and Testcomposer	0	37	37
1999	Bozga M, Fernandez JC, Ghirvu L, Graf S, Krimm JP, <i>et al.</i>	IF: An intermediate representation for SDL and its applications	3	87	90
1997	Mauw S, Reniers MA	High-level Message Sequence Charts	8	137	145
1995	Algayres B, Lejeune Y, Hugonnet F	GOAL: Observing SDL behaviors with GEODE	0	66	66
1993	Grabowski J, Hogrefe D, Nahm R	Test Case Generation with Test Purpose Specification by MSCs	0	110	110
1993	Graubmann P, Rudolph E, Grabowski J	Towards a Petri Net Based Semantics Definition for Message Sequence Charts	0	109	109
1991	Luo G, Das A, von Bochmann G	Test selection based on SDL specifications with save	1	12	13

# RQ1. Proceeding-level Metrics

Year	Sum of Scopus/WoS	Sum of Scholar	Sum of Combined	Number of Papers	Citations per Paper	Citations per Paper / Year	H-index (Scholar)	H-index / Year	Reference
1991	11	126	137	<b>38</b>	3.32	0.13	7	0.27	[8]
1993	0	462	462	37	12.49	0.52	8	0.33	[9]
1995	8	241	249	30	8.03	0.37	9	0.41	[3]
1997	45	<b>517</b>	<b>562</b>	35	14.77	0.74	<b>13</b>	0.65	[4]
1999	37	443	480	30	14.77	0.82	11	0.61	[6]
2000	0	307	307	23	13.35	0.79	11	0.65	[37]
2001	102	348	450	26	13.38	0.84	12	0.75	[33]
2002	81	264	345	15	<b>17.60</b>	1.17	9	0.60	[38]
2003	102	235	337	23	10.22	0.73	11	0.79	[34]
2004	68	201	269	19	10.58	0.81	9	0.69	[2]
2005	<b>138</b>	352	490	24	14.67	1.22	10	0.83	[31]
2006	82	244	326	14	17.43	<b>1.58</b>	8	0.73	[12]
2007	74	179	253	17	10.53	1.05	8	0.80	[11]
2009	62	119	181	15	7.93	0.99	8	1.00	[35]
2010	61	115	176	15	7.67	1.10	7	1.00	[26]
2011	66	127	193	18	7.06	1.18	6	1.00	[30]
2012	40	82	122	14	5.86	1.17	6	1.20	[14]
2013	50	79	129	16	4.94	1.23	5	1.25	[24]
2014	42	80	122	21	3.81	1.27	5	<b>1.67</b>	[1]
2015	8	23	31	19	1.21	0.61	3	1.50	[10]
2016	0	3	3	15	0.20	0.20	1	1.00	[13]
<b>TOTAL</b>	1077	4547	5624	464	9.80	—	32	—	—

## RQ2. Authors with the highest numbers of combined citations

Author	Combined Citations	Scholar Citations	Author	Combined Citations	Scholar Citations
Amyot D	675	489	Fischer	197	147
Grabowski J	516	485	Bozga M	190	174
Gotzhein R	316	243	Mounier L	190	174
Mauw S	286	267	Graubmann P	185	175
Hogrefe D	251	236	Baker P	183	140
Bræk R	250	178	Reniers MA	161	153
Graf S	243	216	Mansurov N	154	133
Rudolph E	241	223	Khendek F	154	116
Roy JF	227	168	Haugen Ø	150	119
Mussbacher G	200	142	Kerbrat A	148	139

# Key Highlights

- 464 papers from 765 authors
- 4,547 citations
- An average of 268 citations per year
- An average of 9.8 citations per paper
- A global H-index of 32

# Other Observations

- 80 out of the 464 papers (17.2%) have not been cited at all (these include 12 papers from 2016).
- These papers come from 177 authors out of 765 (15.3%) who have no citations.
- The number of papers published per year in the last decade is less than the average (22) and seems to continue declining.
- On the other hand, the popularity of these papers is higher as the H-index per year is consistently higher than the average (0.84) since 2009.

# Languages and Topics

- **We searched in the paper titles and keyword sets for:**
  - SDL or Specification and Description Language
  - MSC or Message Sequence Chart
  - TTCN or Testing and Test Control Notation or Tree and Tabular Combined Notation
  - ASN.1 or Abstract Syntax Notation One or ASN 1
  - ODL or Object Description Language. This covers eODL as well
  - CHILL for the ITU-T CHILL programming language
  - UML or Unified Modeling Language
  - OCL or Object Constraint Language
  - Petri for Petri nets.
  - Profile to cover UML profiles and profiling approaches
  - For the User Requirements Notation, which contains two sub-languages, we counted three sets of terms: "GRL" or "Goal-oriented Requirement Language, UCM or Use Case Map, URN or User Requirements Notation

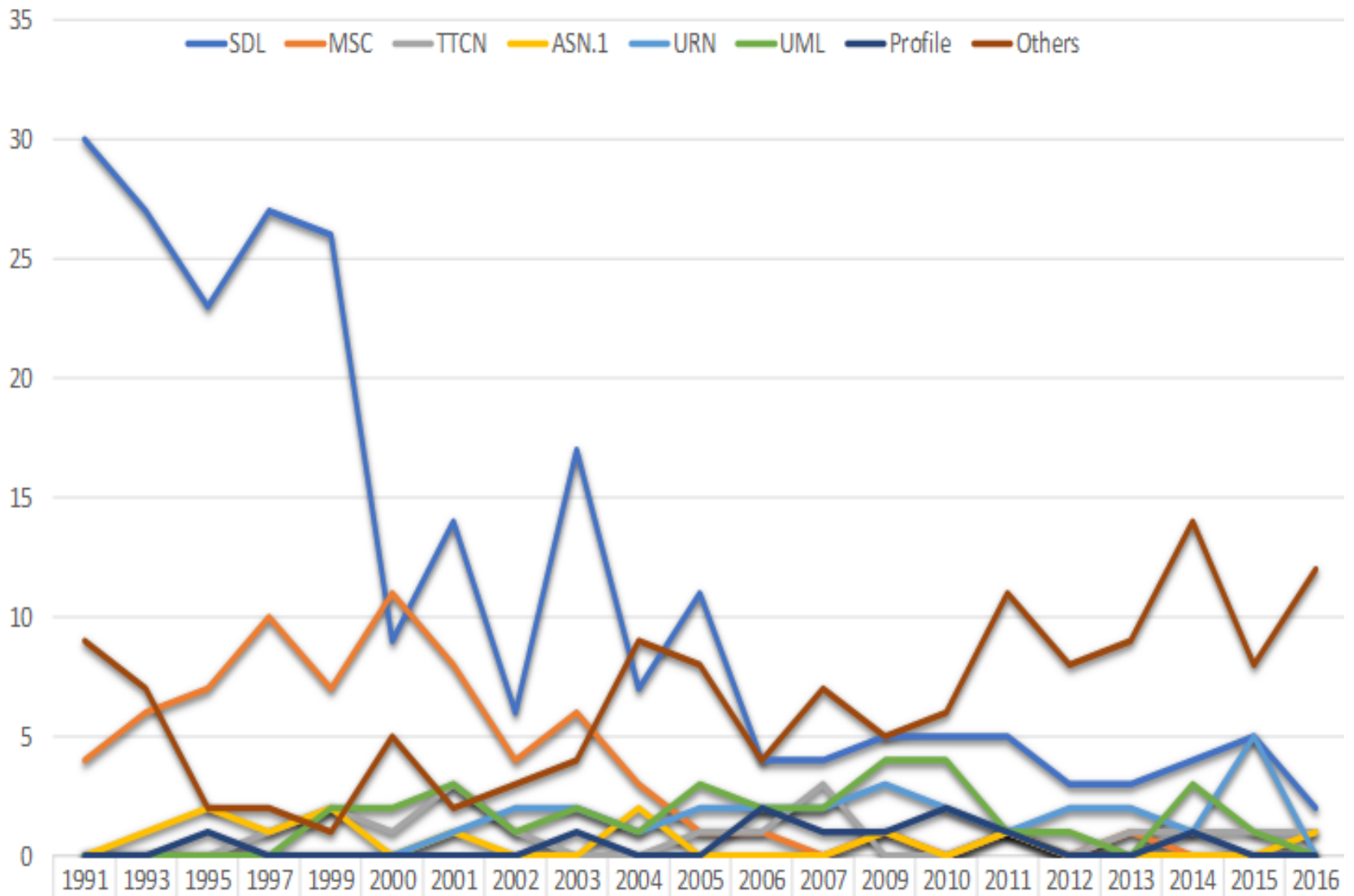




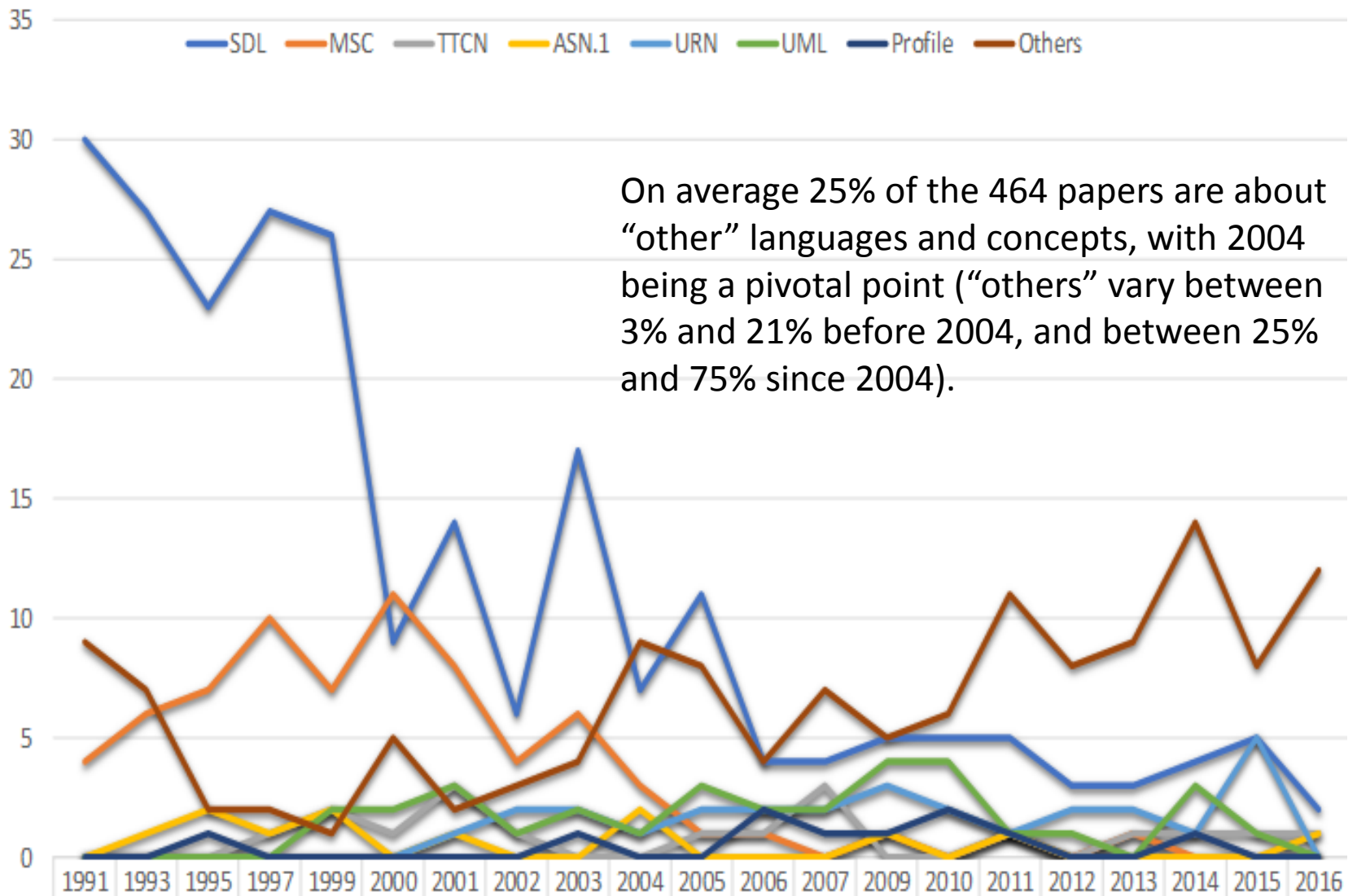
- SDL (51%)
- Others (26%)
- MSC (15%)
- All of the other terms had less than 7%
- Lowest count was 1 for CHILL



# RQ3. Topics and system design languages



# RQ3. Topics and system design languages



# Threats to Validity

- The sources of citations have different levels of quality and research value
  - Google Scholar is unfortunately known to index many of them.
  - We used Scopus and Web of Science in order to put more weight on citations coming from quality sources.
- We did not have the resources to perform a rigorous systematic literature review of the selected 464 papers
  - We relied on frequency analysis based on words found in titles and keywords, whenever available.
- The conclusions may lack precision. The “others” category likely contains papers that focus on the other categories

# Conclusion

- This paper uses citation analysis to answer questions that can help assess the impact of the Society on academic research.
- The data is available on: <https://goo.gl/ZFNfhc>
- We hope that these contributions will trigger a reflection about:
  - Who the Society is, what its successes are, and where it could go from here to address emerging challenges.