



# NIST Cloud Computing Forum and Workshop VIII

## Quantitative Clustering of Cloud Computing Projects for Better Standards Profiling

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# Authors

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# Background

- ◆ We support the European Commission's vision of a digital single market.
- ◆ Standardisation is perceived as a strong enabler.
- ◆ We support over 70 EC-funded projects who generally all have standardisation and interoperability as an objective.
- ◆ **How can we help them?**
- ◆ **We provide a repeatable methodology for cloud standards profiling.**
- ◆ Contributing to the standards landscape: IEEE P2301, ETSI CSC2, ISO/IEC JTC1/SC38

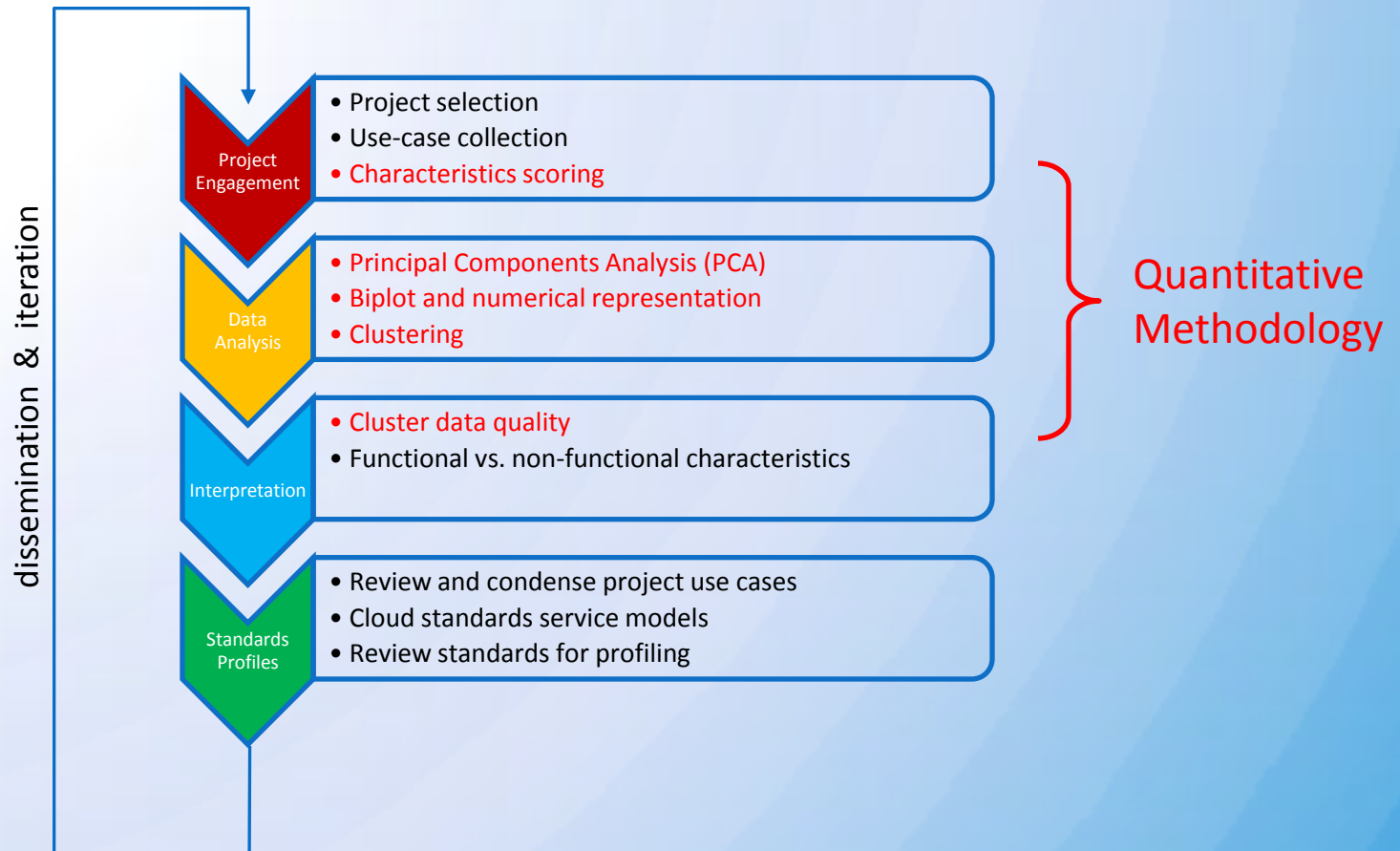


# Our major outputs

- ◆ Set of common standards profiles derived from clustering of initiatives based on the NIST cloud definition characteristics.
- ◆ Increasing awareness of security certification and legal issues with practical recommendations.
- ◆ Set of practical tools to support cloud adoption for SMEs and Public Administrations.



# Workflow



# Defining characteristics of cloud computing

NIST special Publication 800-145 [NIST-800-145]

## Essential Characteristics

- On-demand self service
- Broad network access
- Resource pooling
- Rapid elasticity
- Measured service

## Common Characteristics

- Massive Scale
- Homogeneity
- Virtualization
- Low Cost Software
- Resilient Computing
- Geographic Distribution
- Service Orientation
- Advanced Security



# Defining characteristics of cloud computing

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## Essential Characteristics

- On-demand self service
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## Common Characteristics

- Massive Scale
- Homogeneity
- Virtualization
- Low Cost Software
- Resilient Computing
- Geographic Distribution
- Service Orientation
- Advanced Security

Please find attached the self-assessed scores for CloudLightning, (ICT-7 action from first call H2020):

```
'On Demand Self-Service' : 9
'Broad Network Access': 7
'Resource Pooling': 8
'Rapid Elasticity': 7
'Measured Service': 5
'Massive Scale': 9
'Homogeneity': 5
'Virtualization': 5
'Low Cost Software': 6
'Resilient Computing': 5
'Geographic Distribution': 5
'Service Orientation': 5
'Advanced Security': 3
```

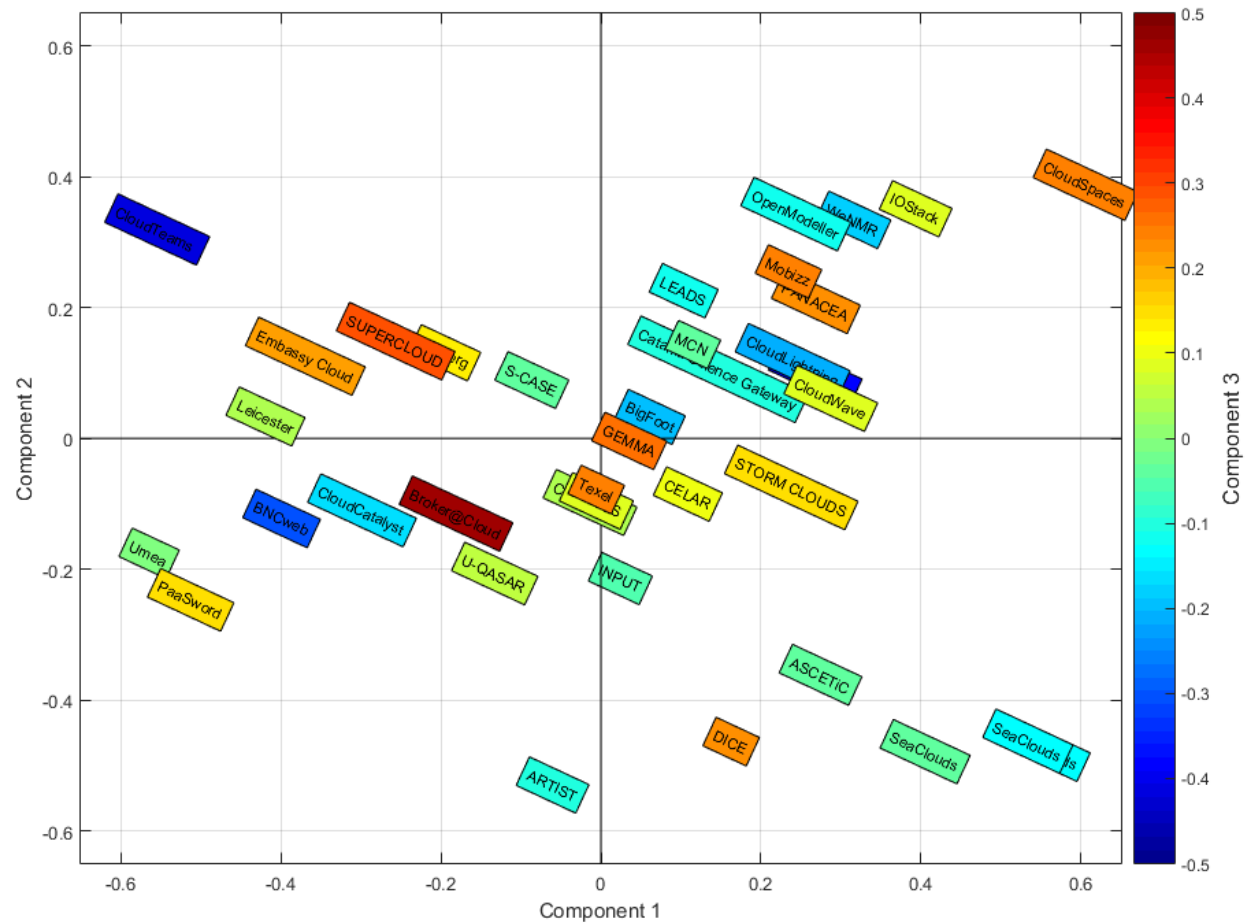
# Principal Components Analysis

## PCA

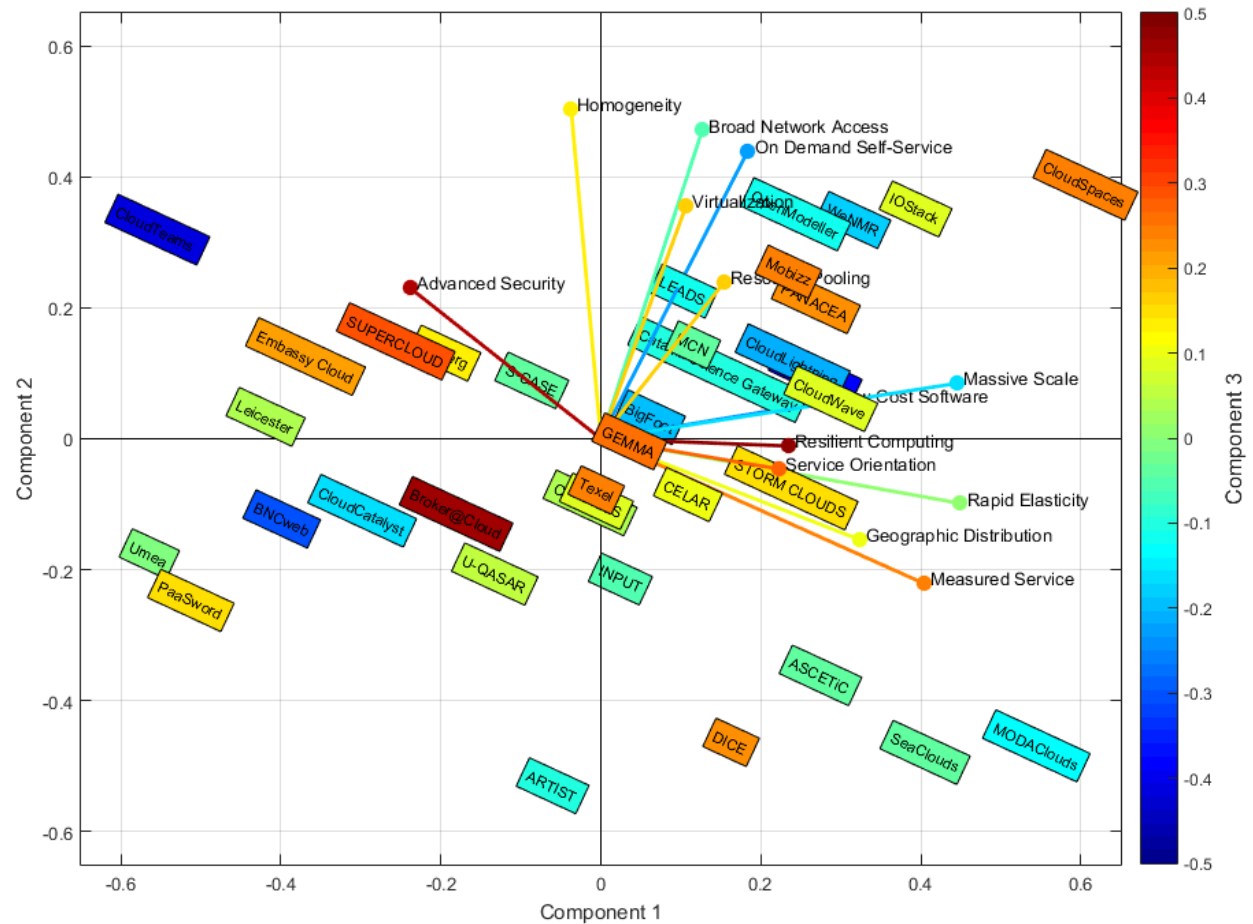
- ◆ was invented in 1901 by Karl Pearson
- ◆ was later independently discovered by Harold Hotelling in the 1930s
- ◆ can be thought of as revealing the internal structure of the data in a way that best explains the variance in the data
- ◆ is mostly used as a tool in exploratory data analysis



# ◆ PCA

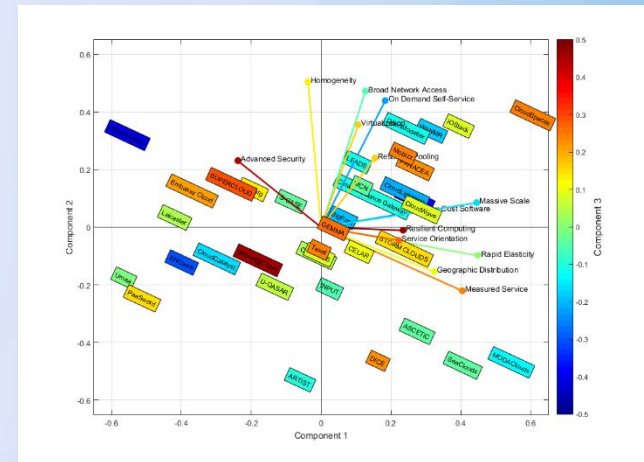
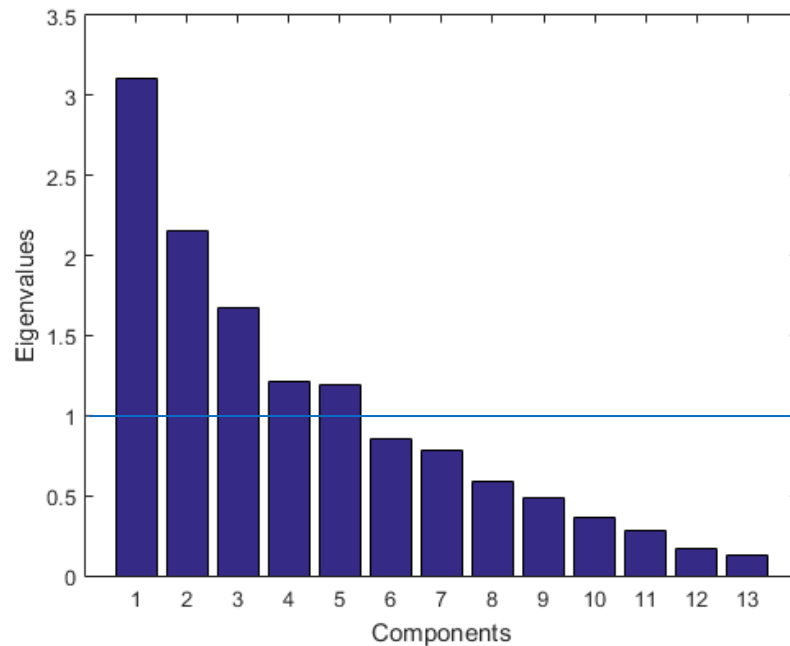


- ◆ PCA
- ◆ Biplot

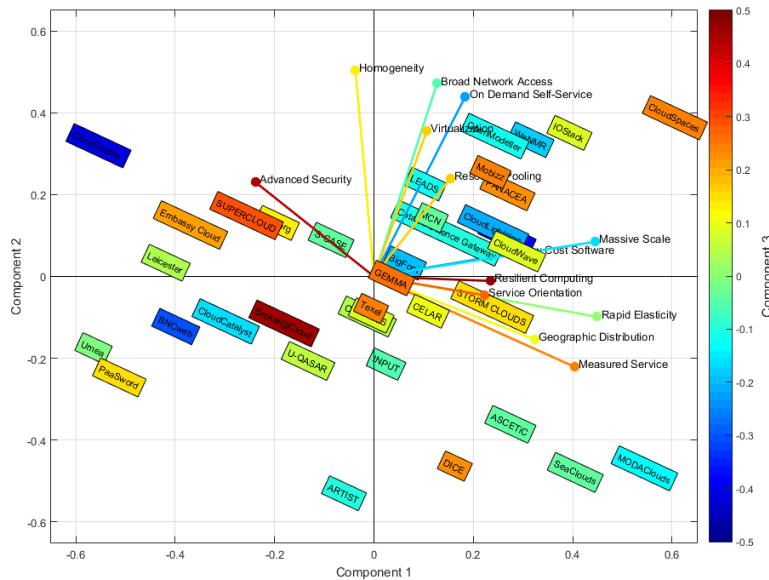


- ◆ PCA
- ◆ Biplot
- ◆ How many components to keep?

Scree plot & Kaiser-Guttman criterion



## ◆ Biplot projection



◆ Heat map

## Numerical representation of the biplot

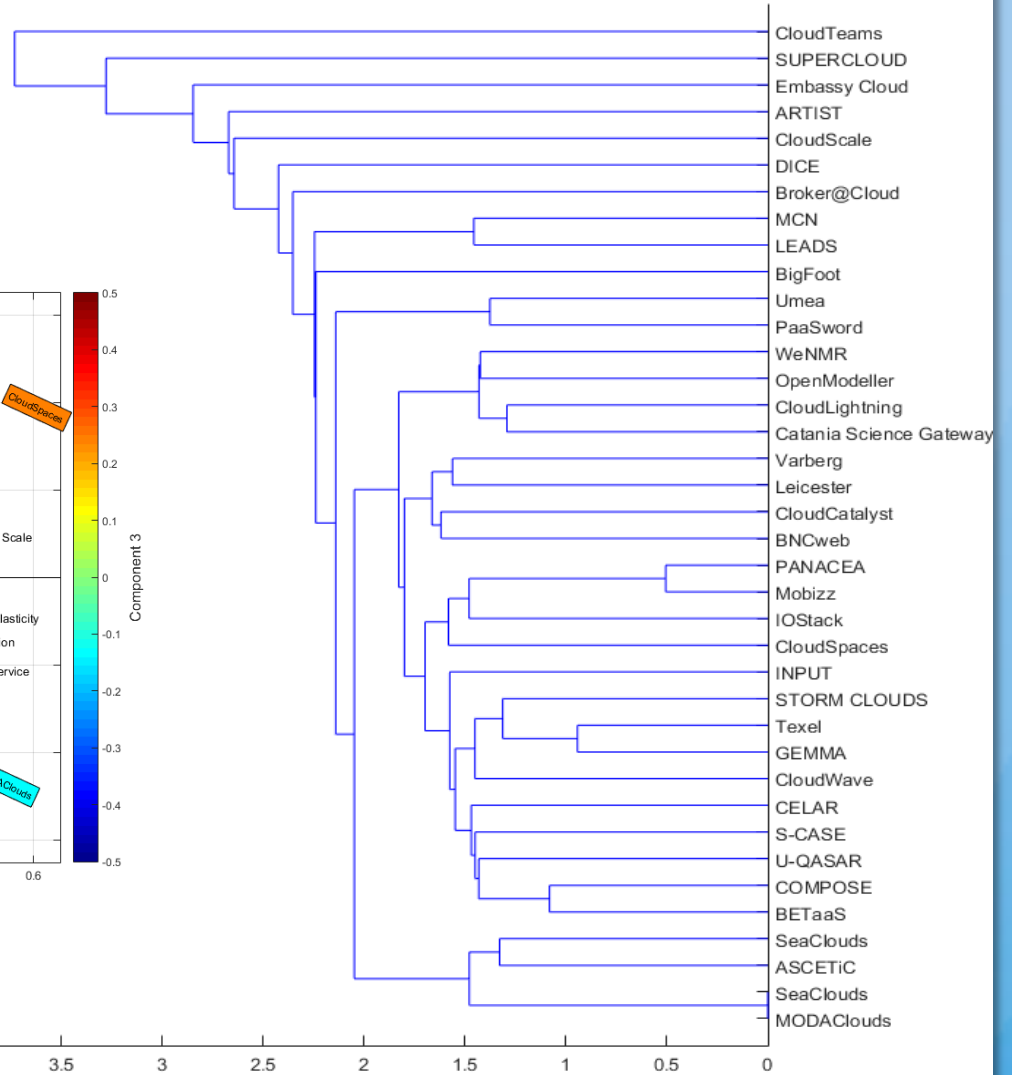
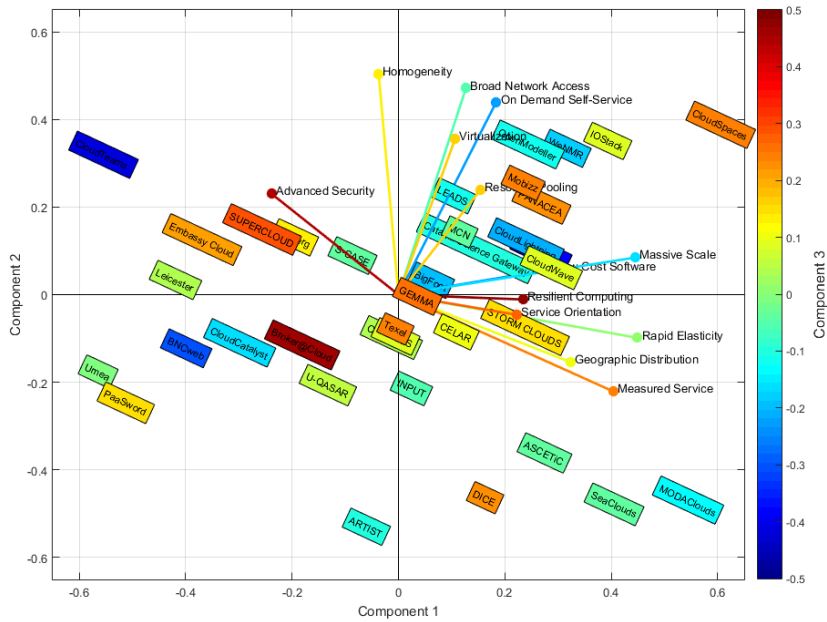
	On Demand Self-Service	Broad Network Access	Resource Pooling	Rapid Elasticity	Measured Service	Massive Scale	Homogeneity	Virtualization	Low Cost Software	Resilient Computing	Geographic Distribution	Service Orientation	Advanced Security
ARTIST	-2.9954	-0.8551	0.9328	1.3410	1.3491	-1.8087	-3.2776	-3.6273	0.4696	-2.0489	-0.1213	-0.0875	-0.6271
ASCETIC	-0.4722	-1.8513	-0.8811	1.2014	0.8952	1.3890	-1.8344	-0.0846	0.0811	0.7540	0.2058	0.0100	-1.8942
BEta5	-0.7266	-0.3648	0.2336	0.1141	0.2694	-0.5393	-0.3033	-0.2654	-0.4488	0.1692	0.1366	-0.0399	0.3494
BigFoot	1.1965	-1.6288	0.7691	1.2799	-1.9822	1.1492	0.3388	1.7470	-1.2443	-0.4724	2.1119	-3.2468	-1.9038
BNcweb	0.0259	-0.4727	-0.2041	-0.2917	-2.2835	-1.0584	-0.9349	-1.3439	0.1190	-2.2685	-2.2252	-0.7711	-0.9742
Broker@Cloud	-2.0893	-1.1106	0.1715	-0.1035	0.4313	-2.1618	0.4470	0.4842	-2.5252	1.9505	-0.0149	0.7493	2.5777
Catania Science Gateway	1.2651	0.1457	0.3532	0.3559	-0.9355	0.8382	0.7983	1.0049	0.0198	-0.3164	0.4615	-1.0802	-0.6798
CELAR	-0.2592	-1.0799	0.3376	0.7646	0.1935	0.3291	-0.0760	0.8158	-0.9381	0.8968	1.4144	-0.5715	-0.2167
CloudCatalyst	-0.5473	-0.3247	-0.5660	-1.2998	-1.5179	-1.4286	-0.6548	-2.1186	-0.3112	-1.8249	-1.5250	-1.0527	-2.0668
CloudLightning	1.4880	0.7337	0.8833	1.2601	-0.4083	1.3493	0.9395	0.3891	1.0533	-0.9748	0.6186	-1.1765	-2.2882
CloudScale	1.9797	0.2056	-0.4147	0.6144	0.1139	1.8418	-0.3243	-0.0548	3.1877	-1.9778	-0.9368	0.3953	-1.8993
CloudSpaces	1.8672	2.4549	1.8844	2.0025	2.1668	2.1580	2.3344	1.9247	1.1633	2.0438	1.2758	1.1719	1.0479
CloudTeams	0.9489	1.9138	1.0331	-1.8256	-3.6417	-2.3564	1.1492	-1.4084	0.3033	-4.5192	-3.6219	-2.9830	0.3201
CloudWave	0.2214	1.5556	0.7880	0.9109	1.6521	0.5579	0.2398	-0.4433	1.4367	-0.2748	-0.0952	1.3291	0.4924
COMPOSE	-0.4289	-0.0656	-0.6234	-0.5898	0.2058	-0.3474	-0.3856	-0.4873	0.0872	0.0553	-0.5118	0.6606	0.2003
DICE	-2.4634	-2.1765	0.4663	1.6661	1.8870	-0.4034	-0.2910	-0.7530	-1.1132	1.2840	2.1592	0.0407	-0.1941
Embassy Cloud	0.0224	-0.1069	-0.2646	-3.5440	-1.5898	-1.5095	1.4730	0.9870	-1.5482	0.9988	-2.1735	1.3067	1.9674
GEMMA	-1.1218	0.3671	1.2406	0.4541	1.0871	-1.0695	0.3563	-0.1787	-0.6006	0.7580	0.0458	0.0801	1.6476
INPUT	-0.3368	-0.0570	-0.1658	0.7153	-0.7088	0.3965	-0.9107	0.5158	-1.1649	0.1164	1.6618	-1.6245	-1.3610
IOStack	1.9657	0.2047	1.0047	1.0332	0.9510	1.7972	1.9365	1.5370	1.2805	1.0582	0.5311	1.0270	0.4310
LEADS	2.5906	0.7243	-2.5570	-1.8621	-1.0080	2.0437	1.2571	1.1808	1.0922	0.7336	-0.7811	1.5565	-0.8481
Leicester	-0.8243	0.0918	-0.2013	-1.9673	-1.4988	-2.3130	0.4160	-0.6665	-1.1140	-1.0405	-0.2060	-0.5290	1.3991
MCN	1.6190	0.5261	-1.4291	-0.9154	-0.3684	1.4114	0.8168	1.0733	0.7557	0.6343	-0.2919	1.0840	-0.8475
Mobiz	0.5033	1.4190	1.6616	0.9659	1.1297	0.2974	1.6928	1.1023	0.0891	1.2561	0.4643	0.7260	1.5314
MODAClouds	-0.3712	-0.8924	-1.1554	1.9806	2.5261	2.3864	-2.8478	-1.3194	2.1242	0.4593	1.9446	1.4238	-0.5507
OpenModeler	2.3437	1.6662	0.7801	0.5852	-0.5552	1.5504	1.7479	1.3063	1.1314	-0.3310	0.0607	-0.4046	-0.4109
PaaSWord	-2.1409	-1.8578	-1.2892	-2.4625	-1.4285	-2.8167	-0.6832	-0.6881	-2.4485	-0.0785	-1.3696	-0.3675	1.2823
PANACEA	0.5907	1.2474	1.2112	0.8431	1.1588	0.5710	1.4591	1.0798	0.2479	1.3326	0.5189	0.9395	1.2100
S-CASE	0.3764	1.1640	-0.6036	-1.2043	-0.2961	-0.4174	0.3568	-0.6105	0.8173	0.7106	-1.6861	0.8198	0.4762
SeaClouds	-0.6257	-1.9163	-1.5754	1.3280	1.8011	1.9739	-2.5365	-0.4830	0.7682	1.1746	2.2379	1.0577	-2.3056
SeaClouds	-0.3712	-0.8924	-1.1554	1.9806	2.5261	2.3864	-2.8478	-1.3194	2.1242	0.4593	1.9446	1.4238	-0.5507
STORM CLOUDS	-0.8468	0.6826	1.4517	1.3748	1.6876	-0.2684	-0.2421	-0.6938	0.4527	0.2928	0.4480	0.5216	0.7485
SUPERCLOUD	-0.0938	-1.6926	0.3439	-0.1500	-1.1322	-1.2256	2.0121	2.7227	-3.5858	1.6068	0.7062	-1.6446	1.5831
Texel	-1.4464	0.4409	0.6938	0.9730	1.3458	-1.2556	-0.1984	-0.8857	-0.1841	0.5092	-0.4677	1.0686	1.6565
Umea	-1.2092	-1.5321	-0.0850	-0.0878	-2.2272	-2.2873	-0.5992	-0.6935	-1.7809	-0.8083	-1.9859	-0.4646	0.5160
U-QASAR	-1.6621	-0.2714	0.3322	-0.1633	0.2675	-1.5994	-1.0425	-1.5616	-0.3221	-0.7178	-0.6984	-0.0865	0.6192
Varberg	-0.4006	0.6717	0.5855	-0.9433	-0.5190	-1.5074	0.9917	-0.0228	-0.7373	-0.1765	-1.2361	-0.0336	1.6534
WenMR	2.4287	1.3137	1.6331	1.7413	-0.5620	1.9470	1.5730	1.5009	1.0011	-0.5523	1.0614	-1.4556	-0.0206

- ◆ Signal  $\mu$
- ◆ Noise  $\sigma$
- ◆ SNR

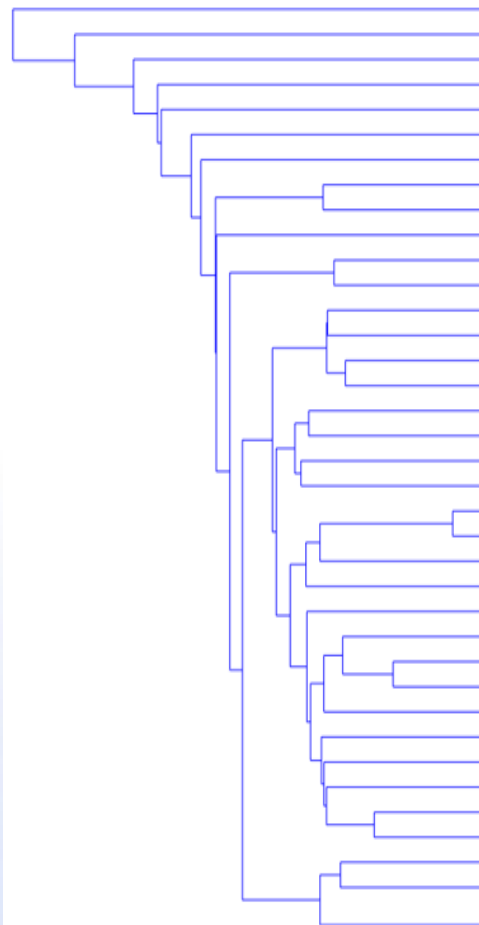
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ASCETIC	-0.4722	-1.8513	-0.8811	1.2014	0.8952	1.3890	-1.8344	-0.0846	0.0811	0.7540	2.0358	0.0100	-1.8942
BETaaS	-0.7266	-0.3648	0.2336	0.1141	0.2694	-0.5393	-0.3033	-0.2654	-0.4488	0.1692	0.1366	-0.0399	0.3495
BigFoot	1.1965	-1.6288	0.7691	1.2799	-1.9822	1.1492	0.3388	1.7470	-1.2443	-0.4724	2.1119	-3.2468	-1.9038
BNCweb	0.0259	-0.4727	-2.0241	-2.3917	-2.2835	-1.0584	-0.9349	-1.3439	0.1190	-2.2685	-2.2252	-0.7711	-0.9742
Broker@Cloud	-2.0893	-1.1106	0.1715	-1.0155	0.4313	-2.1618	0.4470	0.4842	-2.5252	1.9505	-0.0510	0.7493	2.5777
Catania Science Gateway	1.2651	0.1457	0.3532	0.3559	-0.9535	0.8382	0.7983	1.0049	0.0198	-0.3164	0.4615	-1.0802	-0.6798
CELAR	-0.2592	-1.0799	0.3376	0.7646	0.1295	0.3291	-0.0760	0.8158	-0.9381	0.8968	1.4144	-0.5715	-0.2167
CloudCatalyst	-0.5473	-0.3247	-0.5660	-1.2998	-1.5179	-1.4286	-0.6548	-1.2186	-0.3112	-1.8249	-1.5250	-1.0527	-0.2068
CloudLightning	1.4880	0.7337	0.8833	1.2601	-0.4083	1.3493	0.3935	0.3891	1.0533	-0.9748	0.6186	-1.1765	-1.2822
CloudScale	1.9797	2.0256	-0.4147	0.4614	0.1139	1.8418	-0.3243	-1.0548	3.1877	-1.9778	-0.9368	0.3953	-1.8993
CloudSpaces	1.8672	2.4549	1.8844	2.0025	2.1668	2.1580	2.3344	1.9247	1.4163	2.0438	1.2758	1.6719	1.0479
CloudTeams	0.9489	1.9138	1.0331	-1.8256	-3.6417	-2.3564	1.1492	-1.4084	0.3033	-4.5192	-3.6219	-2.9830	0.3201
CloudWave	0.2214	1.5556	0.7880	0.9109	1.6521	0.5579	0.2398	-0.4433	1.4367	0.2748	-0.0952	1.3291	0.4924
COMPOSE	-0.4289	-0.0656	-0.6234	-0.5898	0.2058	-0.3474	-0.3856	-0.4873	0.0872	0.0553	-0.5118	0.6606	0.2003
DICE	-2.4634	-2.1765	0.4663	1.6661	1.8870	-0.4034	-2.0910	-0.7530	-1.1132	1.2840	2.1592	0.0407	-0.1941
Embassy Cloud	0.0224	-0.1069	-2.0646	-3.5440	-1.5898	-1.5095	1.4730	0.9870	-1.5482	0.9988	-2.1735	1.3067	1.9674
GEMMA	-1.1218	0.3671	1.2406	0.4541	1.0871	-1.0695	0.3563	-0.1787	-0.6006	0.7580	0.0458	0.5081	1.6476
INPUT	-0.3368	-2.0570	-0.1658	0.7153	-0.7088	0.3965	-0.9107	0.5158	-1.1649	0.1164	1.6618	-1.6245	-1.3610
IOStack	1.9657	2.0047	1.0047	1.0332	0.9510	1.7972	1.9365	1.5370	1.2805	1.0582	0.5311	1.0270	0.4310
LEADS	2.5906	0.7243	-2.5570	-1.8621	-1.0080	2.0437	1.2571	1.6188	1.0922	0.7336	-0.7811	1.5565	-0.8481
Leicester	-0.8243	0.0918	-0.2013	-1.9673	-1.4988	-2.3130	0.4160	-0.6665	-1.1140	-1.0405	-2.0606	-0.5290	1.3991
MCN	1.6190	0.5261	-1.4291	-0.9154	-0.3684	1.4114	0.8168	1.0733	0.7557	0.6343	-0.2919	1.0840	-0.4875
Mobizz	0.5033	1.4190	1.6616	0.9659	1.1297	0.2974	1.6928	1.1023	0.0891	1.2561	0.4643	0.7260	1.5314
MODAClouds	-0.3712	-0.8924	-1.1554	1.9806	2.5261	2.3864	-2.8478	-1.3194	2.1242	0.4593	1.9446	1.4238	-2.6507
OpenModeller	2.3437	1.6662	0.7801	0.5852	-0.5552	1.5504	1.7479	1.3063	1.1314	-0.3310	0.0607	-0.4046	-0.4109
PaaSword	-2.1409	-1.8578	-1.2892	-2.4625	-1.4285	-2.8167	-0.6832	-0.6881	-2.4485	-0.0785	-1.3696	-0.3675	1.2823
PANACEA	0.5907	1.2474	1.2112	0.8431	1.1588	0.5710	1.4591	1.0798	0.2479	1.3326	0.5189	0.9395	1.2100
S-CASE	0.3764	1.1640	-0.6036	-1.2043	-0.2961	-0.4174	0.3568	-0.6105	0.8173	-0.7106	-1.6861	0.8198	0.4762
SeaClouds	-0.6257	-1.9163	-1.5754	1.3280	1.8011	1.9739	-2.5365	-0.4830	0.7682	1.1746	2.2379	1.0577	-2.3056
SeaClouds	-0.3712	-0.8924	-1.1554	1.9806	2.5261	2.3864	-2.8478	-1.3194	2.1242	0.4593	1.9446	1.4238	-2.6507
STORM CLOUDS	-0.8468	0.6826	1.4517	1.3743	1.6876	-0.2684	-0.2421	-0.6938	0.4527	0.2928	0.4480	0.5216	0.7485
SUPERCLOUD	-0.0938	-1.6926	0.3439	-1.1500	-2.1322	-1.2256	2.0121	2.7227	-3.5858	1.6068	0.7062	-1.6446	1.5831
Texel	-1.4464	0.4409	0.6938	0.0730	1.3458	-1.2556	-0.1984	-0.8857	-0.1841	0.5092	-0.4677	1.0686	1.5665
Umea	-1.2092	-1.5321	-2.0850	-3.0878	-2.2272	-2.2873	-0.5992	-0.6935	-1.7809	-0.8083	-1.9859	-0.4646	0.5160
U-QASAR	-1.6621	-0.2714	0.3322	-0.1633	0.3675	-1.5994	-1.0425	-1.5616	-0.3221	-0.7178	-0.6984	-0.0865	0.6192
Varberg	-0.4006	0.6717	0.5855	-0.9433	-0.5190	-1.5074	0.9917	-0.0228	-0.7373	-0.1765	-1.2361	-0.0336	1.6534
WeNMR	2.4287	1.3137	1.6331	1.7313	-0.5620	1.9470	1.5730	1.5009	1.0101	-0.5523	1.0614	-1.4556	-1.0268
Signal	0	0	0	0	0	0	0	0	0	0	0	0	0
Noise	1.4156	1.3247	1.1789	1.5196	1.5084	1.5856	1.4493	1.2712	1.3789	1.3186	1.4479	1.2071	1.3691
SNR	0	0	0	0	0	0	0	0	0	0	0	0	0



# Clustering







	On Demand Self-Service	Broad Network Access	Resource Pooling	Rapid Elasticity	Measured Service	Massive Scale	Homogeneity	Virtualization	Low Cost Software	Resilient Computing	Geographic Distribution	Service Orientation	Advanced Security
CloudTeams	0.9489	1.9138	1.0331	-1.8256	-3.6417	-2.3564	1.1492	-1.4084	0.3033	-4.5192	-3.6219	-2.9830	0.3201
SUPERCLOUD	-0.0938	-1.6926	0.3439	-1.1500	-2.1322	-1.2256	2.0121	2.7227	-3.5858	1.6068	0.7062	-1.6446	1.5831
Embassy Cloud	0.0224	-0.1069	-2.0646	-3.5440	-1.5898	-1.5095	1.4730	0.9870	-1.5482	0.9988	-2.1735	1.3067	1.9674
ARTIST	-2.9954	-0.8551	0.9328	1.3410	1.3491	-1.8087	-3.2776	-3.6273	0.4696	-2.0489	-0.1213	-0.7875	-0.6271
CloudScale	1.9797	2.0256	-0.4147	0.4614	0.1139	1.8418	-0.3243	-1.0548	3.1877	-1.9778	-0.9368	0.3953	-1.8993
DICE	-2.4634	-2.1765	0.4663	1.6661	1.8870	-0.4034	-2.0910	-0.7530	-1.1132	1.2840	2.1592	0.0407	-0.1941
Broker@Cloud	-2.0893	-1.1106	0.1715	-1.0155	0.4313	-2.1618	0.4470	0.4842	-2.5252	1.9505	-0.0510	0.7493	2.5777
MCN	1.6190	0.5261	-1.4291	-0.9154	-0.3684	1.4114	0.8168	1.0733	0.7557	0.6343	-0.2919	1.0840	-0.4875
LEADS	2.5906	0.7243	-2.5570	-1.8621	-1.0080	2.0437	1.2571	1.6188	1.0922	0.7336	-0.7811	1.5565	-0.8481
BigFoot	1.1965	-1.6288	0.7691	1.2799	-1.9822	1.1492	0.3388	1.7470	-1.2443	-0.4724	2.1119	-3.2468	-1.9038
Umea	-1.2092	-1.5321	-2.0850	-3.0878	-2.2272	-2.2873	-0.5992	-0.6935	-1.7809	-0.8083	-1.9859	-0.4646	0.5160
PaaSword	-2.1409	-1.8578	-1.2892	-2.4625	-1.4285	-2.8167	-0.6832	-0.6881	-2.4485	-0.0785	-1.3696	-0.3675	1.2823
WeNMR	2.4287	1.3137	1.6331	1.7313	-0.5620	1.9470	1.5730	1.5009	1.0101	-0.5523	1.0614	-1.4556	-1.0268
OpenModeller	2.3437	1.6662	0.7801	0.5852	-0.5552	1.5504	1.7479	1.3063	1.1314	-0.3310	0.0607	-0.4046	-0.4109
CloudLightning	1.4880	0.7337	0.8833	1.2601	-0.4083	1.3493	0.3935	0.3891	1.0533	-0.9748	0.6186	-1.1765	-1.2822
Catania Science Gateway	1.2651	0.1457	0.3532	0.3559	-0.9535	0.8382	0.7983	1.0049	0.0198	-0.3164	0.4615	-1.0802	-0.6798
Varberg	-0.4006	0.6717	0.5855	-0.9433	-0.5190	-1.5074	0.9917	-0.0228	-0.7373	-0.1765	-1.2361	-0.0336	1.6534
Leicester	-0.8243	0.0918	-0.2013	-1.9673	-1.4988	-2.3130	0.4160	-0.6665	-1.1140	-1.0405	-2.0606	-0.5290	1.3991
CloudCatalyst	-0.5473	-0.3247	-0.5660	-1.2998	-1.5179	-1.4286	-0.6548	-1.2186	-0.3112	-1.8249	-1.5250	-1.0527	-0.2068
BNCweb	0.0259	-0.4727	-2.0241	-2.3917	-2.2835	-1.0584	-0.9349	-1.3439	0.1190	-2.2685	-2.2252	-0.7711	-0.9742
PANACEA	0.5907	1.2474	1.2112	0.8431	1.1588	0.5710	1.4591	1.0798	0.2479	1.3326	0.5189	0.9395	1.2100
Mobizz	0.5033	1.4190	1.6616	0.9659	1.1297	0.2974	1.6928	1.1023	0.0891	1.2561	0.4643	0.7260	1.5314
IOStack	1.9657	2.0047	1.0047	1.0332	0.9510	1.7972	1.9365	1.5370	1.2805	1.0582	0.5311	1.0270	0.4310
CloudSpaces	1.8672	2.4549	1.8844	2.0025	2.1668	2.1580	2.3344	1.9247	1.4163	2.0438	1.2758	1.6719	1.0479
INPUT	-0.3368	-2.0570	-0.1658	0.7153	-0.7088	0.3965	-0.9107	0.5158	-1.1649	0.1164	1.6618	-1.6245	-1.3610
STORM CLOUDS	-0.8468	0.6826	1.4517	1.3743	1.6876	-0.2684	-0.2421	-0.6938	0.4527	0.2928	0.4480	0.5216	0.7485
Texel	-1.4464	0.4409	0.6938	0.0730	1.3458	-1.2556	-0.1984	-0.8857	-0.1841	0.5092	-0.4677	1.0686	1.5665
GEMMA	-1.1218	0.3671	1.2406	0.4541	1.0871	-1.0695	0.3563	-0.1787	-0.6006	0.7580	0.0458	0.5081	1.6476
CloudWave	0.2214	1.5556	0.7880	0.9109	1.6521	0.5579	0.2398	-0.4433	1.4367	0.2748	-0.0952	1.3291	0.4924
CELAR	-0.2592	-1.0799	0.3376	0.7646	0.1295	0.3291	-0.0760	0.8158	-0.9381	0.8968	1.4144	-0.5715	-0.2167
S-CASE	0.3764	1.1640	-0.6036	-1.2043	-0.2961	-0.4174	0.3568	-0.6105	0.8173	-0.7106	-1.6861	0.8198	0.4762
U-QASAR	-1.6621	-0.2714	0.3322	-0.1633	0.3675	-1.5994	-1.0425	-1.5616	-0.3221	-0.7178	-0.6984	-0.0865	0.6192
COMPOSE	-0.4289	-0.0656	-0.6234	-0.5898	0.2058	-0.3474	-0.3856	-0.4873	0.0872	0.0553	-0.5118	0.6606	0.2003
BETaaS	-0.7266	-0.3648	0.2336	0.1141	0.2694	-0.5393	-0.3033	-0.2654	-0.4488	0.1692	0.1366	-0.0399	0.3495
SeaClouds	-0.6257	-1.9163	-1.5754	1.3280	1.8011	1.9739	-2.5365	-0.4830	0.7682	1.1746	2.2379	1.0577	-2.3056
ASCETIC	-0.4722	-1.8513	-0.8811	1.2014	0.8952	1.3890	-1.8344	-0.0846	0.0811	0.7540	2.0358	0.0100	-1.8942
SeaClouds	-0.3712	-0.8924	-1.1554	1.9806	2.5261	2.3864	-2.8478	-1.3194	2.1242	0.4593	1.9446	1.4238	-2.6507
MODAClouds	-0.3712	-0.8924	-1.1554	1.9806	2.5261	2.3864	-2.8478	-1.3194	2.1242	0.4593	1.9446	1.4238	-2.6507

Signal	0	0	0	0	0	0	0	0	0	0	0	0	0
Noise	1.4156	1.3247	1.1789	1.5196	1.5084	1.5856	1.4493	1.2712	1.3789	1.3186	1.4479	1.2071	1.3691
SNR	0	0	0	0	0	0	0	0	0	0	0	0	0

	On Demand Self-Service	Broad Network Access	Resource Pooling	Rapid Elasticity	Measured Service	Massive Scale	Homogeneity	Virtualization	Low Cost Software	Resilient Computing	Geographic Distribution	Service Orientation	Advanced Security
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WeNMR	2.4287	1.3137	1.6331	1.7313	-0.5620	1.9470	1.5730	1.5009	1.0101	-0.5523	1.0614	-1.4556	-1.0268
OpenModeller	2.3437	1.6662	0.7801	0.5852	-0.5552	1.5504	1.7479	1.3063	1.1314	-0.3310	0.0607	-0.4046	-0.4109
CloudLightning	1.4880	0.7337	0.8833	1.2601	-0.4083	1.3493	0.3935	0.3891	1.0533	-0.9748	0.6186	-1.1765	-1.2822
Catania Science Gateway	1.2651	0.1457	0.3532	0.3559	-0.9535	0.8382	0.7983	1.0049	0.0198	-0.3164	0.4615	-1.0802	-0.6798
Signal	1.8814	0.9648	0.9124	0.9832	-0.6198	1.4212	1.1282	1.0503	0.8036	-0.5436	0.5506	-1.0292	-0.8500
Noise	0.5910	0.6678	0.5324	0.6294	0.2335	0.4612	0.6404	0.4857	0.5249	0.3070	0.4137	0.4458	0.3829
SNR	3.1834	1.4448	1.7136	1.5622	-2.6540	3.0813	1.7616	2.1622	1.5309	-1.7706	1.3308	-2.3087	-2.2198

	On Demand Self-Service	Broad Network Access	Resource Pooling	Rapid Elasticity	Measured Service	Massive Scale	Homogeneity	Virtualization	Low Cost Software	Resilient Computing	Geographic Distribution	Service Orientation	Advanced Security
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INPUT	-0.3368	-2.0570	-0.1658	0.7153	-0.7088	0.3965	-0.9107	0.5158	-1.1649	0.1164	1.6618	-1.6245	-1.3610
STORM CLOUDS	-0.8468	0.6826	1.4517	1.3743	1.6876	-0.2684	-0.2421	-0.6938	0.4527	0.2928	0.4480	0.5216	0.7485
Texel	-1.4464	0.4409	0.6938	0.0730	1.3458	-1.2556	-0.1984	-0.8857	-0.1841	0.5092	-0.4677	1.0686	1.5665
GEMMA	-1.1218	0.3671	1.2406	0.4541	1.0871	-1.0695	0.3563	-0.1787	-0.6006	0.7580	0.0458	0.5081	1.6476
CloudWave	0.2214	1.5556	0.7880	0.9109	1.6521	0.5579	0.2398	-0.4433	1.4367	0.2748	-0.0952	1.3291	0.4924
CELAR	-0.2592	-1.0799	0.3376	0.7646	0.1295	0.3291	-0.0760	0.8158	-0.9381	0.8968	1.4144	-0.5715	-0.2167
S-CASE	0.3764	1.1640	-0.6036	-1.2043	-0.2961	-0.4174	0.3568	-0.6105	0.8173	-0.7106	-1.6861	0.8198	0.4762
U-QASAR	-1.6621	-0.2714	0.3322	-0.1633	0.3675	-1.5994	-1.0425	-1.5616	-0.3221	-0.7178	-0.6984	-0.0865	0.6192
COMPOSE	-0.4289	-0.0656	-0.6234	-0.5898	0.2058	-0.3474	-0.3856	-0.4873	0.0872	0.0553	-0.5118	0.6606	0.2003
BETaaS	-0.7266	-0.3648	0.2336	0.1141	0.2694	-0.5393	-0.3033	-0.2654	-0.4488	0.1692	0.1366	-0.0399	0.3495
Signal	-0.6231	0.0371	0.3685	0.2449	0.5740	-0.4214	-0.2206	-0.3795	-0.0865	0.1644	0.0247	0.2585	0.4523
Noise	0.6693	1.0627	0.7032	0.7648	0.8255	0.7255	0.4814	0.6754	0.8032	0.5369	0.9887	0.8726	0.8562
SNR	-0.9310	0.0350	0.5240	0.3202	0.6954	-0.5808	-0.4582	-0.5619	-0.1076	0.3062	0.0250	0.2963	0.5282

	On Demand Self-Service	Broad Network Access	Resource Pooling	Rapid Elasticity	Measured Service	Massive Scale	Homogeneity	Virtualization	Low Cost Software	Resilient Computing	Geographic Distribution	Service Orientation	Advanced Security
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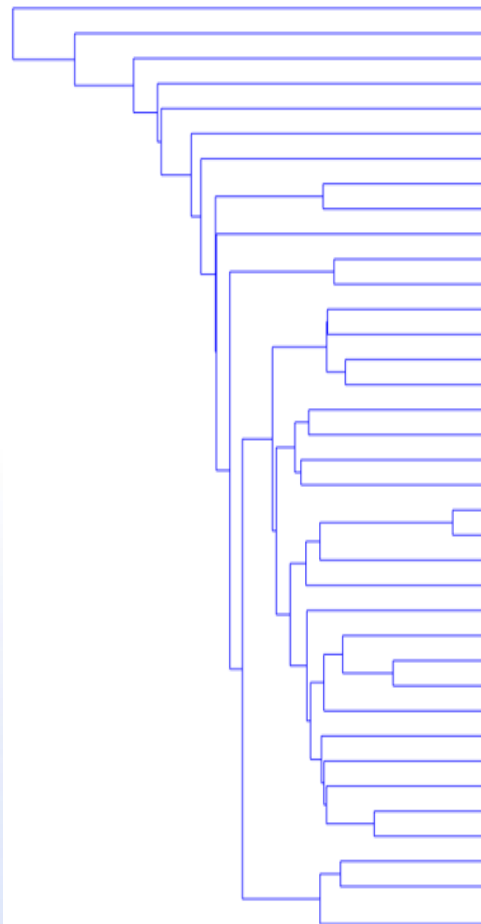


STORM CLOUDS	-0.8468	0.6826	1.4517	1.3743	1.6876	-0.2684	-0.2421	-0.6938	0.4527	0.2928	0.4480	0.5216	0.7485
Texel	-1.4464	0.4409	0.6938	0.0730	1.3458	-1.2556	-0.1984	-0.8857	-0.1841	0.5092	-0.4677	1.0686	1.5665
GEMMA	-1.1218	0.3671	1.2406	0.4541	1.0871	-1.0695	0.3563	-0.1787	-0.6006	0.7580	0.0458	0.5081	1.6476
CloudWave	0.2214	1.5556	0.7880	0.9109	1.6521	0.5579	0.2398	-0.4433	1.4367	0.2748	-0.0952	1.3291	0.4924
Signal	-0.7984	0.7616	1.0436	0.7031	1.4432	-0.5089	0.0389	-0.5504	0.2762	0.4587	-0.0173	0.8568	1.1137
Noise	0.7227	0.5462	0.3620	0.5636	0.2827	0.8302	0.3035	0.3069	0.8867	0.2262	0.3783	0.4090	0.5801
SNR	-1.1047	1.3942	2.8830	1.2475	5.1057	-0.6130	0.1281	-1.7931	0.3115	2.0281	-0.0456	2.0947	1.9200

	On Demand Self-Service	Broad Network Access	Resource Pooling	Rapid Elasticity	Measured Service	Massive Scale	Homogeneity	Virtualization	Low Cost Software	Resilient Computing	Geographic Distribution	Service Orientation	Advanced Security
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WeNMR	2.4287	1.3137	1.6331	1.7313	-0.5620	1.9470	1.5730	1.5009	1.0101	-0.5523	1.0614	-1.4556	-1.0268
OpenModeller	2.3437	1.6662	0.7801	0.5852	-0.5552	1.5504	1.7479	1.3063	1.1314	-0.3310	0.0607	-0.4046	-0.4109
CloudLightning	1.4880	0.7337	0.8833	1.2601	-0.4083	1.3493	0.3935	0.3891	1.0533	-0.9748	0.6186	-1.1765	-1.2822
Catania Science Gateway	1.2651	0.1457	0.3532	0.3559	-0.9535	0.8382	0.7983	1.0049	0.0198	-0.3164	0.4615	-1.0802	-0.6798

STORM CLOUDS	-0.8468	0.6826	1.4517	1.3743	1.6876	-0.2684	-0.2421	-0.6938	0.4527	0.2928	0.4480	0.5216	0.7485
Texel	-1.4464	0.4409	0.6938	0.0730	1.3458	-1.2556	-0.1984	-0.8857	-0.1841	0.5092	-0.4677	1.0686	1.5665
GEMMA	-1.1218	0.3671	1.2406	0.4541	1.0871	-1.0695	0.3563	-0.1787	-0.6006	0.7580	0.0458	0.5081	1.6476
CloudWave	0.2214	1.5556	0.7880	0.9109	1.6521	0.5579	0.2398	-0.4433	1.4367	0.2748	-0.0952	1.3291	0.4924



	On Demand Self-Service	Broad Network Access	Resource Pooling	Rapid Elasticity	Measured Service	Massive Scale	Homogeneity	Virtualization	Low Cost Software	Resilient Computing	Geographic Distribution	Service Orientation	Advanced Security
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WeNMR	2.4287	1.3137	1.6331	1.7313	-0.5620	1.9470	1.5730	1.5009	1.0101	-0.5523	1.0614	-1.4556	-1.0268
OpenModeller	2.3437	1.6662	0.7801	0.5852	-0.5552	1.5504	1.7479	1.3063	1.1314	-0.3310	0.0607	-0.4046	-0.4109
CloudLightning	1.4880	0.7337	0.8833	1.2601	-0.4083	1.3493	0.3935	0.3891	1.0533	-0.9748	0.6186	-1.1765	-1.2822
Catania Science Gateway	1.2651	0.1457	0.3532	0.3559	-0.9535	0.8382	0.7983	1.0049	0.0198	-0.3164	0.4615	-1.0802	-0.6798

STORM CLOUDS	-0.8468	0.6826	1.4517	1.3743	1.6876	-0.2684	-0.2421	-0.6938	0.4527	0.2928	0.4480	0.5216	0.7485
Texel	-1.4464	0.4409	0.6938	0.0730	1.3458	-1.2556	-0.1984	-0.8857	-0.1841	0.5092	-0.4677	1.0686	1.5665
GEMMA	-1.1218	0.3671	1.2406	0.4541	1.0871	-1.0695	0.3563	-0.1787	-0.6006	0.7580	0.0458	0.5081	1.6476
CloudWave	0.2214	1.5556	0.7880	0.9109	1.6521	0.5579	0.2398	-0.4433	1.4367	0.2748	-0.0952	1.3291	0.4924

SeaClouds	-0.6257	-1.9163	-1.5754	1.3280	1.8011	1.9739	-2.5365	-0.4830	0.7682	1.1746	2.2379	1.0577	-2.3056
ASCETIC	-0.4722	-1.8513	-0.8811	1.2014	0.8952	1.3890	-1.8344	-0.0846	0.0811	0.7540	2.0358	0.0100	-1.8942
SeaClouds	-0.3712	-0.8924	-1.1554	1.9806	2.5261	2.3864	-2.8478	-1.3194	2.1242	0.4593	1.9446	1.4238	-2.6507
MODAClouds	-0.3712	-0.8924	-1.1554	1.9806	2.5261	2.3864	-2.8478	-1.3194	2.1242	0.4593	1.9446	1.4238	-2.6507



# Summary of characteristic profiles (1)

## ◆ Cluster 1 - *Scientific Computing*

### ◆ Positive characteristics

- ◆ On-demand self service
- ◆ Massive Scale
- ◆ ...

### ◆ Negative characteristics

- ◆ Measured Service
- ◆ Service Orientation
- ◆ ...

# Summary of characteristic profiles (2)

## ◆ Cluster 2 - *Trusted Public Clouds for Government*

### ◆ Positive characteristics

- ◆ Measured Service
- ◆ Advanced Security
- ◆ ...

### ◆ Negative characteristics

- ◆ On Demand Self-service
- ◆ Massive Scale
- ◆ ...

# Summary of characteristic profiles (3)

## ◆ Cluster 3 - *High-performance, dedicated purpose applications*

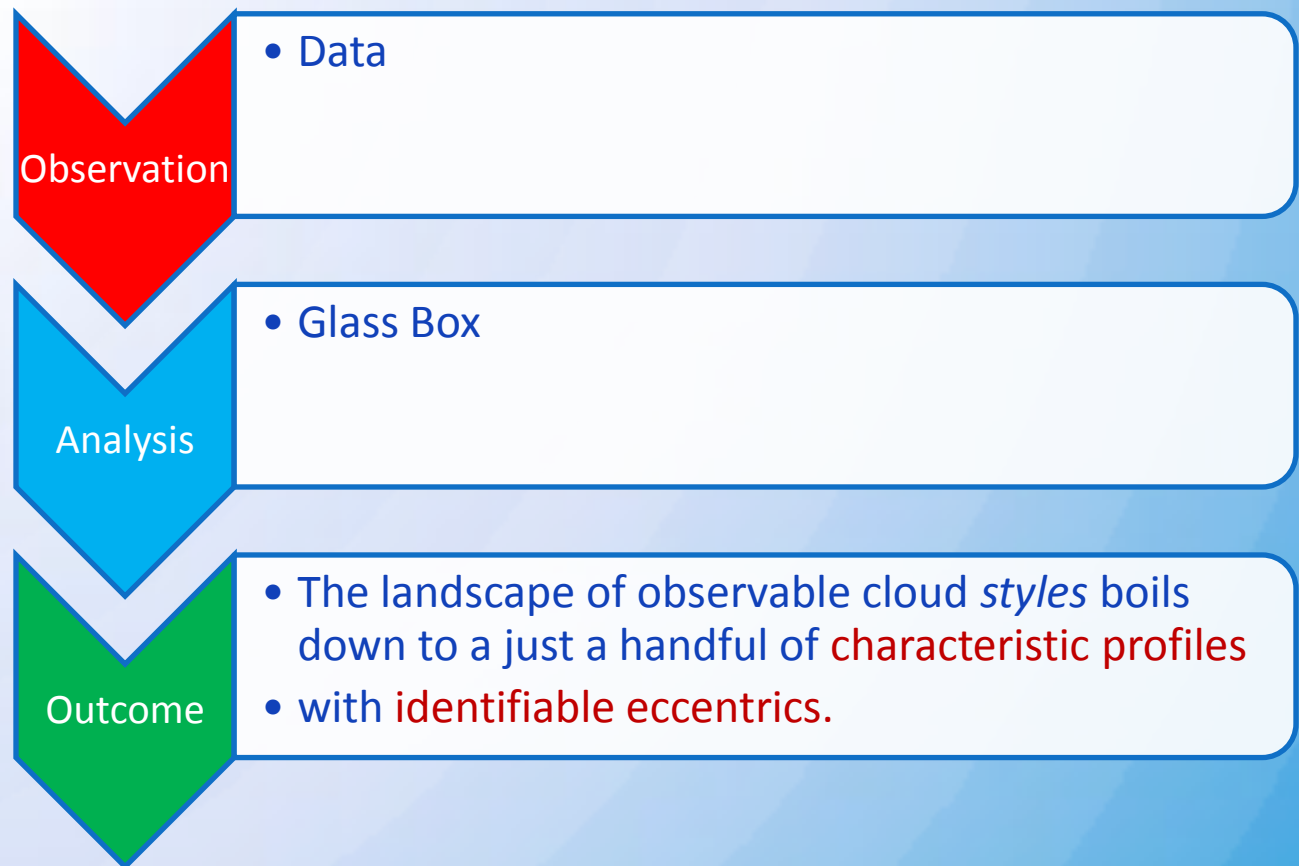
### ◆ Positive characteristics

- ◆ Measured Service
- ◆ Massive Scale
- ◆ ...

### ◆ Negative characteristics

- ◆ Homogeneity
- ◆ Advanced Security
- ◆ ...

# Outcome?



## D4.3 Final report on Cloud standards profile development

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# Next Steps

- ◆ Brussels, 24 September 2015 - Inviting EC cloud projects to contribute further to the cloud standards profiles.
- ◆ Contributing to IEEE P2301 Guide for Cloud Portability and Interoperability Profiles.
- ◆ CloudWATCH2 - September 2015 - August 2017 - Continuing to map the cloud ecosystem and promoting adoption of cloud standards profiles.





