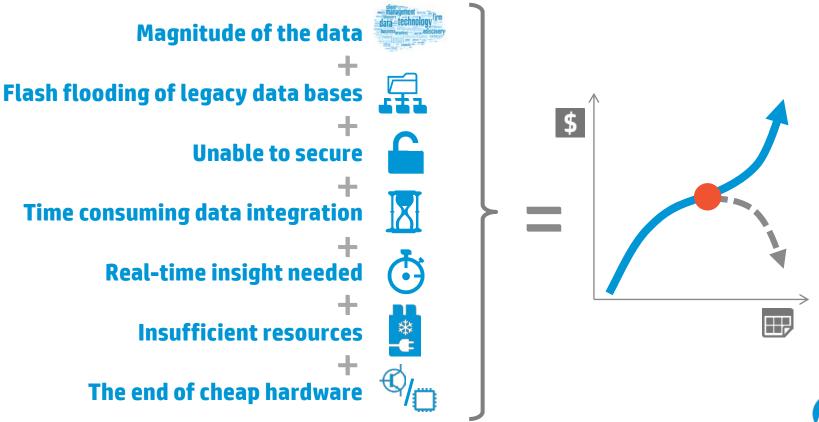


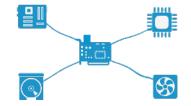
The Machine: The future of technology

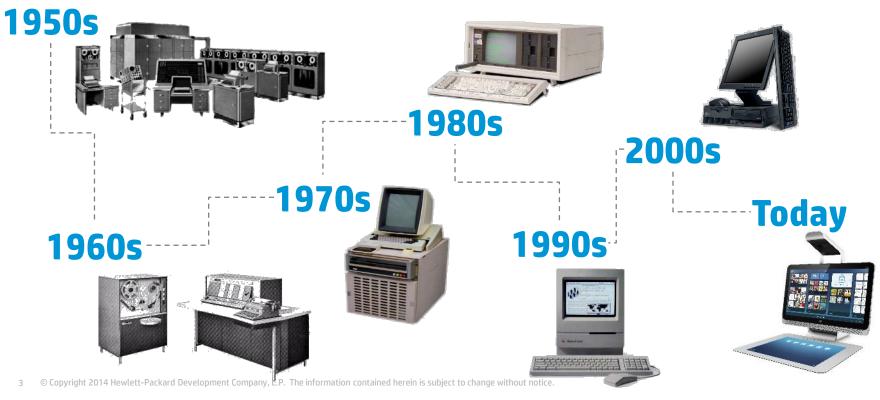
HP Labs

What are the questions you can't ask today?

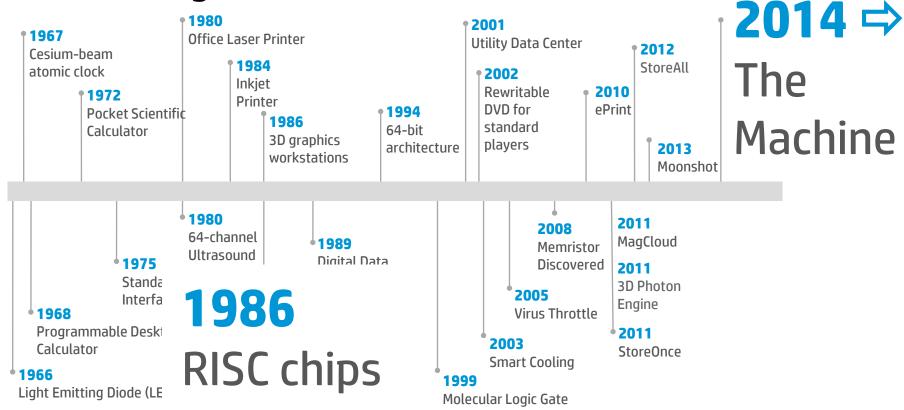


The Past 60 Years

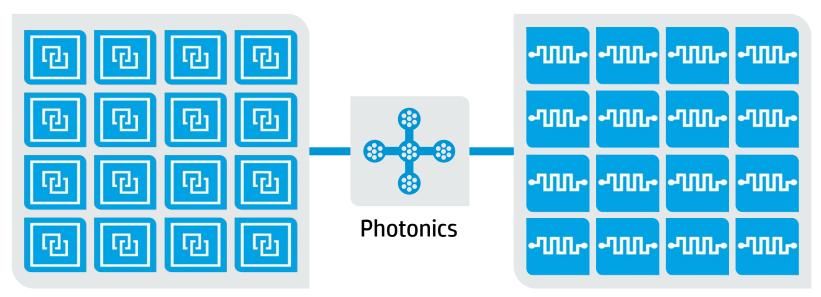




HP Labs: engine of innovation





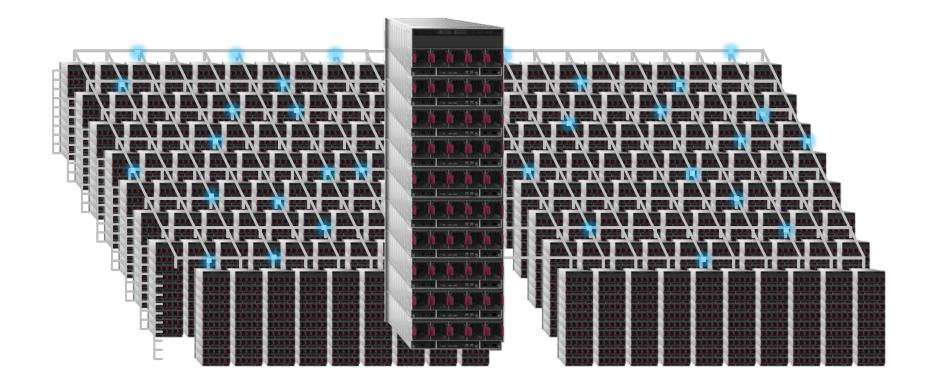


Special purpose cores

Massive memory pool

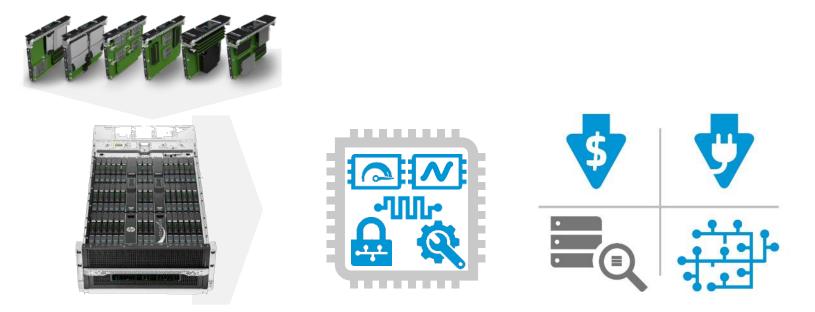
The Machine





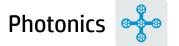






Customize the hardware to the workload

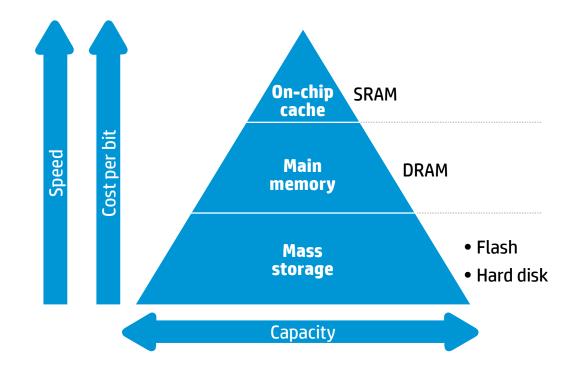






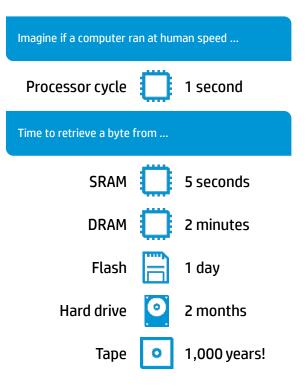
Photonics destroys distance

Massive memory pool

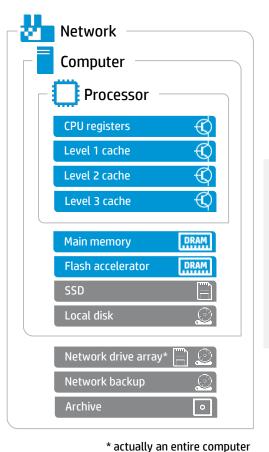


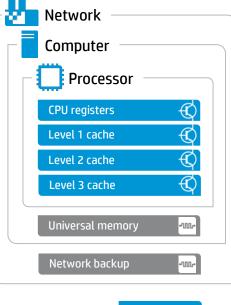
Universal memory obsoletes this hierarchy







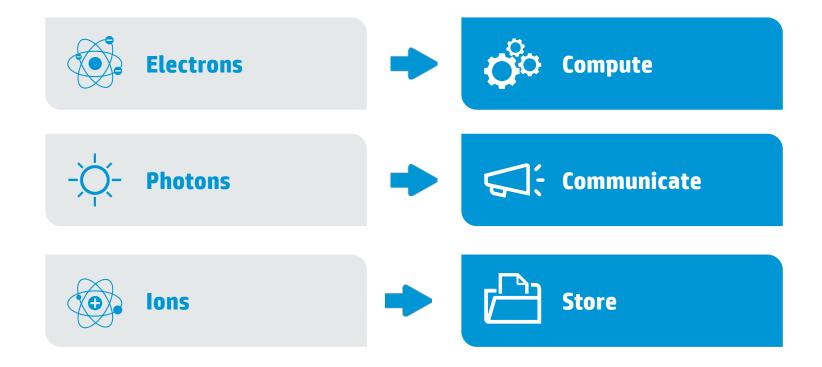




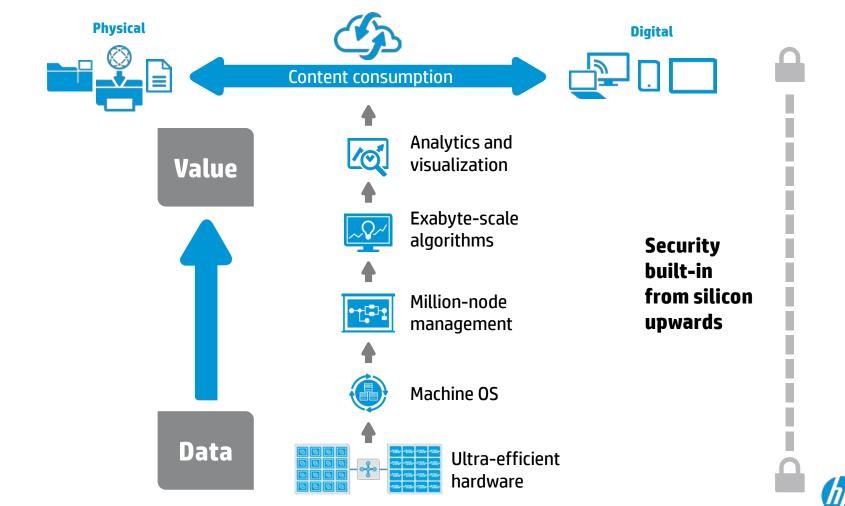




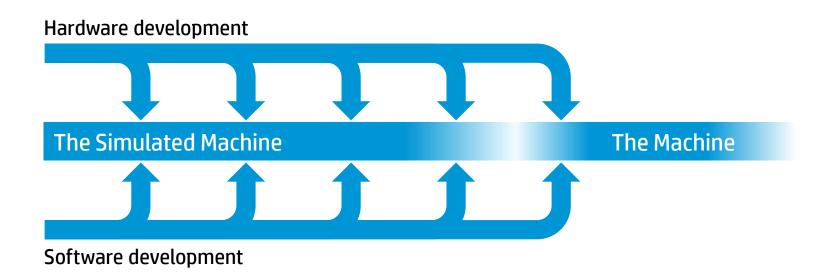
system with its own hierarchy







Hardware/software co-development





| Applic | | n series and ser | |
|---|--|--|--|
| | ations PlacesSystem 😻 🍩 📘 | 4 | |
| - | tmas blade_0.gxe.lpc_uartC | 19387 /home/jizrawi/tmas_run/run_0.5/checkpoint000 _ O x | |
| | | | |
| PP Li | | | |
| Faces Last | | HET 2014 or tty51 Thu Jun 12 15:10:25 DT 2014 x85_54 | |
| Alloc | thenachine:/nrt/ueb/hp_disc ated shared menniston data a ng "Helio Warld ⊀rom Themac | at 0x000000000000000 | |
| | iizrawi@tatsd:~/tmas_rur | n/run 0.5/checkpoint000 _ 🗆 🗆 🗙 | |
| File Edi | jizrawi@tatsd:~/tmas_rur t View Search Terminal Help | n/run_0.5/checkpoint000 _ C × | |
| TOR addr IvyBridg IvyBridg TOR addr IvyBridg Ivy | L Vice Search Terminal Help cs: abaaaaaatha 128000 e 36 (cell 0, socket 1, cor blo24 (cell 0, socket 1, cor blo24 (cell 0, socket 1, cor blo35 (cell 0, socket | <pre>(a) thread (b): Status = Nummable (b): Status = Nummable (c): Status = Low Power PONT (c) 1, thread (b): Status = Nummable (c): Status = Nummable (c): Status = Nummable (c): Status = Low Power PONT (c): Status = Lo</pre> | |
| TOR addr IvyBridg Tvy | L Vice Search Terminal Help cs: ababased half28000 e 36 (cell 0; accket 1, cor olb24 (cell 4, accket 0, cor olb24 (cell 4, accket 0, cor ess: ababased accesso ababased accesso blobs (cell 4, accket 1, cor ess: ababased 1, cor olb35 (cell 4, accket 1, cor olb36 (cell 4, accket | <pre>(a) thread (b): Status = Nummable (b): Status = Nummable (c): Status = Low Power PONT (c) 1, thread (b): Status = Nummable (c): Status = Nummable (c): Status = Nummable (c): Status = Low Power PONT (c): Status = Lo</pre> | |

| Care File ESC for enu; '?' for hel General Revisiters D000000000000000000000000000000000000 | | tmas Rots W | /indo | w 193 | 62/ho | me/jizr | awi/tm | as_run/ | run_0 | .5/check | poin | 0003 | | x |
|--|---------|-------------|-------|---------|-------|---------|--------|---------|-------|----------|------|-------|---------|------|
| Cremeral Resisters Docodings Constraint Docodings | ew Eile | | | | | | | | | ESC f | or e | enu: | '?' for | helr |
| D0007/TF83T14=CB D0007/TF83T14=C0 D0007/TF83T14=C0 D000000000000000000000000000000000000 | | eral Regis | sters | 3 | | | | | | 200 1 | | | | |
| D0007/T183114-460 00 0000000040400858 10 0000000040000000000000000000000000000 | 000000 | 0000000000 | L bx | | | | | | | | | | | |
| 000000000000000000000000000000000000 | 000076 | ff83f14cal | 3 bp | | | | | | | | | | | |
| Segment Resisters Converters 00037 mc1 002% dc 0000 mc1 00000 mc1 0000000000 | | | | | | | | | | | | | | |
| 0033 cr.0 002h de 0000 cr.0 0000 de 0000 cr.0 0000 de 0000 cr.0 0000 de 0000 cr.0 00000 de 0000 cr.0 000000 de 0000 cr.0 00000000 de 0000 cr.0 00000000000 de 0000 cr.0 0000000000000 de 000000000 cr.0 000000000000000 de 0000000000 cr.0 000000000000000 de 00000000000 cr.0 000000000000000000 de 00000000000000000000000000000000000 | | | | | ff83 | f14db/ | 0 14 | 000000 | 0000 | 000000 | 15 | 00000 | 0000000 | 0000 |
| Control Regitterr cr2 00000000000000 cr3 00000000000 cr3 00000000000 cr3 00000000000 cr3 000000000000 cr3 0000000000000 cr3 0000000000000 cr3 00000000000000 cr3 0000000000000000 cr3 000000000000000000000000000000000000 | | | | | | | | | | | | | | |
| crcl 000000000000000000000000000000000000 | | | | | 65 | 0000 | ie. | 0000 | 65 | 0000 | dt.r | 0000 | ter 00 | 40 |
| crt 000000000000000000000000000000000000 | | | | | | | | | | | | | | |
| xrr0 000000000000000000000000000000000000 | | | | | | | | | | | 00 | 00000 | | |
| bssc = 0.00000000000000000000000000000000000 | | | | | cra | 0000 | 00000 | 000000 | 00 | mxcsr | | | 000011 | 80 |
| Processor 34 CPL - 3 SMM - No mode - 64-bit D0000000040070 POP REX D000000040072 PUSH D0000000040072 PUSH REP S000000040072 PUSH D0000000040072 PUSH REP S000000040072 PUSH D00000000400772 PUSH REP S0000000040077 PUSH D00000000400774 HUW REM S0000000040077 PUSH D00000000400776 USH REM S0000000040077 PUSH D00000000400776 S1mfr1 SEQ2 SEQ2 S0000000040079 S00000000040079 POP D000000000400791 POP REM S000000000400791 POP REM S000000000400791 POP SEQ2 S000000000040791 NOP S0000000000000791 NOP S000000000000000000000000000000000000 | | | | | | | | 774 | | 1 | 00 | 00000 | | 202 |
| 000000000400770 POP REX 00000000400772 PUSH REP 00000000400773 H/W REP, RSP 00000000400773 H/W REP, RSP 00000000400774 H/W REX, RSP 00000000400774 Simpi Start 0000000040774 Simpi Start 0000000040774 Simpi Start 0000000040774 Simpi Start 0000000040774 Simpi Start 0000000040774 Simpi Start 0000000040775 Simpi Start 0000000040775 Simpi Start 00000000400758 Simpi Start 000000004000758 Simpi Start 000000000400758 Simpi Start 000000000400758 Simpi Start 0000000004000758 Simpi Start 0000000000000000058 Simpi Start 00000000000000000000 Simpi Start 00000000000000000000 Simpi Start 0000000000000000000 Simpi Start 0000000000000000000 Simpi Start 0000000000000000000 Simpi Start 0000000000000000000 Simpi Start 0000000000000000000 Simpi Start 000000000000000000 Simpi Start 00000000000000000 Simpi Start 000000000000000000 Simpi Start 00000000000000000 Simpi Start 00000000000000000 Simpi Start 0000000000000000 Simpi Start 00000000000000000 Simpi Start 00000000000000000 Simpi Start 0000000000000000 Simpi Start 0000000000000000 Simpi Start 0000000000000000 Simpi Start 0000000000000000 Simpi Start 0000000000000000 Simpi Start 0000000000000000 Simpi Start 00000000000000000 Simpi Start 000000000000000000 Simpi Start 000000000000000000 Simpi Start 0000000000000000 Simpi Start 00000000000000000 Simpi Start 00000000000000000 Simpi Start 000000000000000000 Simpi Start 000000000000000000 Simpi Start 000000000000000000 Simpi Start 0000000000000000000 Simpi Start 0000000000000000000 Simpi Start 000000000000000000000 Simpi Start 000000000000000000000000000 Simpi Start 00000000000000000000000 Simpi Start 0000000000000000000000 Simpi Start 000000000000000000000000000000000000 | | | 700 r | | | | | | | | | | 0000000 | 202 |
| D000000000000000072 PUET D000000000000072 PUEN RBP D000000000000772 PUEN RBP D000000000000772 PUEN RBP D00000000000076 PUEN RBP D0000000000000076 FUEN RBX D00000000000000078 Simpi Stell D0000000000000078 D0000000000000078 Simpi Stell D000000000000078 D0000000000000078 Simpi Stell D000000000000078 D00000000000000078 Simpi Stell D000000000000078 D0000000000000078 NUP D00000000000079 D0000000000000079 NUP D000000000000078 D00000000000000079 NUP D000000000000078 D00000000000000000 F P20000000000000000 D0000000000000000 F P2000000000000000000000000000000000000 | | | | | TL - | | SHH | no | n | ode | 64- | DIL | | |
| 00000000040773 HUV RBP, RSP 0000000040773 HUV RBP, RSP 00000000400776 HUV RBX, RCX 00000000400776 LSINF, SEQ 00000000400776 LSINF, SEQ 0000000040784 LSINF, SEQ 0000000040785 LSINF, SEQ 0000000040785 LSINF, SEQ 00000000400785 LSINF, SEQ 00000000400785 LSINF, SEQ 00000000400785 LSINF, SEQ 00000000400785 LSINF, SEQ 00000000400785 LSINF, SEQ 00000000400785 LSINF, SEQ 000000004000785 LSINF, SEQ 000000004000785 LSINF, SEQ 0000000040000785 LSINF, SEQ 0000000004000785 LSINF, SEQ 0000000004000785 LSINF, SEQ 0000000000000000785 LSINF, SEQ 0000000000000000785 LSINF, SEQ 0000000000000000785 LSINF, SEQ 00000000000000000785 LSINF, SEQ 00000000000000000785 LSINF, SEQ 00000000000000000785 LSINF, SEQ 00000000000000000000000 LSI 00000000000000000000000 LSI 00000000000000000000000000 LSI 000000000000000000000000000000000000 | | | > | | | nuA | | | | | | | | |
| 000000000140775 PUSI 00000000140776 PUSI 00000000140776 PUSI 00000000140776 PUSI 00000000140778 PSInhp1 SEQ1 00000000140788 Sinhp1 SEQ2 00000000140788 Sinhp1 SEQ2 00000000140788 Sinhp1 SEQ2 000000001407978 Sinhp1 SEQ2 000000001407978 Sinhp1 SEQ2 000000001407978 Sinhp1 SEQ2 000000001407978 Sinhp1 SEQ2 000000001407978 Sinhp1 SEQ2 000000001407978 Sinhp1 SEQ2 00000000140798 Sinhp1 SEQ2 00000000140798 Sinhp1 SEQ2 000000004040798 Sinhp1 SEQ2 0000000004040798 Sinhp1 SEQ2 00000000040000794 NUP 00000000040000794 Sinhp1 SEQ2 00000000040000795 Sinhp1 SEQ2 00000000000000000000 SEQ 00000000000000000 SEQ 0000000000000000 SEC 000000000000000 SEC 00000000000000 SEC 00000000000000 SEC 00000000000000 SEC 00000000000000 SEC 00000000000000 SEC 00000000000000 SEC 000000000000000 SEC 000000000000000 SEC 00000000000000 SEC 000000000000000 SEC 000000000000000 SEC 000000000000000 SEC 00000000000000 SEC 000000000000000 SEC 00000000000000 SEC 00000000000000 SEC 000000000000000 SEC 00000000000000 SEC 000000000000000 SEC 000000000000000 SEC 00000000000000 SEC 000000000000000 SEC 0000000000000000 SEC 0000000000000000 SEC 0000000000000000 SEC 0000000000000000 SEC 0000000000000000 SEC 000000000000000000000000000000000000 | | | | | | RRP | | | | | | | | |
| 000000000400776 PUSI RIX 00000000400777 HUV RIX, C.+TFFFFFFFFFFFFFFFF 00000000440784 SinApi SEQ2 0000000040784 SinApi SEQ2 0000000040785 SinApi SEQ2 0000000040785 SinApi 0x0F 0000000040785 SinApi 0x0F 0000000040785 SinApi 0x0F 0000000040785 SinApi 0x0F 0000000040785 SinApi 0x0F 00000000400785 SinApi 0x0F 00000000400785 SinApi 0x0F 00000000040785 SinApi 0x0F 00000000040785 SinApi 0x0F 000000000400785 SinApi 0x0F 000000000400785 SinApi 0x0F 0000000004000785 SinApi 0x0F 0000000004000785 SinApi 0x0F 0000000000000000785 SinApi 0x0F 0000000000000000785 SinApi 0x0F 0000000000000000785 SinApi 0x0F 0000000000000000785 SinApi 0x0F 00000000000000000055 SinApi 0x0F 00000000000000000055 SinApi 0x0F 00000000000000000055 SinApi 0x0F 00000000000000000055 SinApi 0x0F 0000000000000000000055 SinApi 0x0F 00000000000000000055 SinApi 0x0F 000000000000000000055 SinApi 0x0F 0000000000000000000 SinApi 0x0F 000000000000000000 SinApi 0x0F 00000000000000000 SinApi 0x0F 00000000000000000 SinApi 0x0F 0000000000000000 SinApi 0x0F 00000000000000000 SinApi 0x0F 00000000000000000 SinApi 0x0F 0000000000000000 SinApi 0x0F 00000000000000000 SinApi 0x0F 00000000000000000 SinApi 0x0F 0000000000000000 SinApi 0x0F 000000000000000 SinApi 0x0F 0000000000000000 SinApi 0x0F 0000000000000000 SinApi 0x0F 0000000000000000 SinApi 0x0F 00000000000000000 SinApi 0x0F 00000000000000000 SinApi 0x0F 0000000000000000 SinApi 0x0F 00000000000000000 SinApi 0x0F 00000000000000000 SinApi 0x0F 0000000000000000 SinApi 0x0F 0000000000000000 SinApi 0x0F 000000000000000000 SinApi 0x0F 00000000000000000 SinApi 0x0F 00000000000000000000000 SinApi 0x0F 0000000000000000000000 SinApi 0x0F 0000000000000000000000000000000000 | | | | | | | RSP | | | | | | | |
| 00000000040784 0000000040784 0000000040784 0000000040785 0000000040785 0000000040785 0000000040785 0000000040785 0000000040785 0000000040785 0000000040785 0000000040785 0000000040785 0000000040785 0000000040785 000000004000785 000000004000785 000000000400785 000000000400785 0000000004000785 0000000004000785 000000000000000785 00000000000000005 00000000000000005 00000000 | | | | | | | | | | | | | | |
| 000000000400784 5 imp_1 5E02 0000000040785 0000000040785 00000000400795 00000000400795 00000000400795 00000000400792 00000000400792 00000000400792 00000000400794 00000000400794 00000000400795 00000000400795 00000000400795 00000000400795 00000000400795 000000000400795 000000000400795 000000000400795 000000000400795 000000000400795 0000000004000795 0000000004000795 0000000004000795 0000000004000795 0000000004000795 00000000040000795 00000000040000795 00000000040000795 000000000000000005 0000000000000000 | 0000000 | 000400/// | | MDV | | RAX. | 0×ff | FFFFFF | ffff | FFFF | | | | |
| 00000000040788 51mfp1 5E02 0000000040786 51mfp1 5c02 000000004040796 50 F0P REX 00000000440791 0P REP 00000000440791 0P REP 00000000440793 NOP 00000000440793 NOP 00000000440793 NOP 00000000440793 NOP 00000000440795 NOP 00000000440795 NOP 00000000440795 NOP 00000000440795 NOP 00000000440795 NOP 000000004040795 NOP 000000004040795 NOP 000000004040795 NOP 00000000040000795 NOP 00000000040000795 NOP 00000000000000000000 F0 00000000000000 | 0000000 | 000400781 | | NDV | | RBX, | REX | | | | | | | |
| 0000000040788 Sinhji SEQ2 0000000440786 Sinhji 0x0F 0000000440736 Sinhji 0x0F 0000000440736 Sinhji 0x0F 0000000440731 POP RBP 0000000440732 RET 0000000440733 NUP 0000000440733 NUP 0000000440733 NUP 0000000440735 NUP 0000000440735 NUP 0000000440735 NUP 0000000440735 NUP 0000000440735 NUP 0000000440735 NUP 0000000440735 NUP 0000000440735 NUP 00000000440735 NUP 00000000440735 NUP 00000000440735 NUP 000000000440735 NUP 000000000440735 NUP 000000000440735 NUP 00000000000000015 T 00000000000000010 T 0000000000000000 T 000000000000000 | 0000000 | 000400784 | | SinApt | | SEQ1 | | | | | | | | |
| 0000000004007910 POP RBX 00000000400791 POP RBP 000000004040791 POP RBP 000000004040792 RET 000000004040793 NOP 000000004040793 NOP 000000004040795 NOP 000000004040795 NOP 000000004040795 NOP 000000004040795 NOP 000000004040795 NOP 000000004040795 NOP 000000004040795 NOP 000000004040795 NOP 00000000040000795 NOP 00000000040000795 NOP 0000000000000000075 NOP 0000000000000000000 FS/27000000000000000000000000000000000000 | 0000000 | 000400788 | | | | SE02 | | | | | | | | |
| D00000000400791 PDP BBP D0000000400792 REF BBP D0000000400794 NUP D0000000400785 D0000000400785 NUP D00000000400786 D00000000400789 NUP D0000000000010 D00000000000010 I P222222222222222222222222222222222222 | 0000000 | 00040078c | | Simfipi | | 10x0 | | | | | | | | |
| 0000000004010792 RET 00000000410793 NDP 00000000410793 NDP 000000004100795 NDP 000000004100795 NDP 000000004100795 NDP 000000004010799 NDP 000000000410799 NDP 0000000000400799 NDP 0000000000040079 NDP 00000000000000019 I 10000000000000001 I 10000000000000000 | | | | | | | | | | | | | | |
| 000000000400793 NDP 00000000400794 NDP 00000000400795 NDP 00000000400795 NDP 00000000400795 NDP 00000000400795 NDP 00000000400798 NDP 00000000400798 NDP 0000000000000010 I 2 000008000000010 I 2 000008000000000 I 5 000008000000000 F 5 00000800000000 F 5 00000000000000 F 5 0000000000 | | | | POP | | RBP | | | | | | | | |
| 0000000004040795 NUP 00000000440795 NUP 00000000440795 NUP 00000000440795 NUP 00000000440795 NUP 00000000440795 NUP 00000000440795 NUP 000000004400795 NUP 0000000044000000000 I 00000000000000001 I 0000000000 | | | | | | | | | | | | | | |
| 000000000140795 NUP 00000000140796 NUP 00000000140796 NUP 00000000140798 NUP 00000000140798 NUP 000000000000010 I 1 000008000000010 I 1 000008000000010 I 1 000008000000001 I 1 000008000000000 I 1 0000080000000000 I 1 0000080000000000 I 1 0000080000000000 I 1 000000000000000 I 1 0000000000 | | | | | | | | | | | | | | |
| 000000000400/95 NUP 00000000400/97 NUP 00000000400795 NUP Class Hindow 0 Class Hindow 0 Class Hindow 0 0000080000000001 1 0000080000000001 1 000008000000000 FFX-2006Gec6541 Bek/Fib/2006027 Utata Hindow 1 View: Newristor Address is inear 000008000000000 FFX-2006Gec6541 Bek/Fib/200627 000008000000000 FFX-2006Gec6541 Bek/Fib/200627 000008000000000 FFX-2006Gec6541 Bek/Fib/200627 000008000000000 FFX-2006Gec6541 Bek/Fib/200627 000008000000000 FFX-2006Gec6541 Bek/Fib/20060000000000 | | | | | | | | | | | | | | |
| 000000000140797 NRP 00000000040798 NRP 000000004040798 NRP 000000004040798 NRP 00000000000400799 NRP 000008000000010 I 20222222222222222222222222222222222 | | | | | | | | | | | | | | |
| 000000000400798 N0P DDts Hindow 0 Vest: Cache (2) Andress is: Linear 000000004004079 N0P 000008000000000 I 2222222222222222222222222222 | | | | | | | | | | | | | | |
| 0000000004040799 NUP Dit UITdaw 0 View: Cache (2) fiddress is: Linear 000008000000010 I 1 200008000000010 I 200008000000010 I 2000080000000010 I 2000080000000010 I 2000080000000000 I 200008000000000 I 20000800000000 I 200008000000000 I 200008000000000 I 200008000000000 I 200008000000000 I 2000000000000 I 200008000000000 I 20000800000000 I 200008000000000 I 20000800000000 I 20000800000000 I 200008000000000 I 20000800000000 I 200008000000000 I 20000800000000 I 20000800000000 I 200008000000000 I 200008000000000 I 200008000000000 I 200008000000000 I 20000800000000 I 200008000000000 I 200008000000000 I 200008000000000 I 200008000000000 I 20000800000000 I 200008000000000 I 200008000000000 I 200008000000000 I 20008000000000 I 20008000000000 I 20008000000000 I 200080000000000 I 200080000000000 I 200080000000000 I 200080000000000 I 200080000000000 I 20008000000000 I 200080000000000 I 200080000000000 I 200080000000000 I 200080000000000 I 200080000000000 I 20008000000000 I 200080000000000 I 200080000000000 I 20008000000000 I 200080000000000 I 200080000000000 I 200080000000000 I 20008000000000 I 200080000000000 I 200080000000000 I 200080000000000 I 200080000000000 I 20008000000000 I 200080000000000 I 20008000000000 I 200080000000000 I 20008000000000000 I 200080000000000 I 200080000000000000 I 200080000000000000000000 I 2 | | | | | | | | | | | | | | |
| Deta Hindow 0 Vseu: Coche(2) Andrews is: Linear D000080000000000 I 222222222222222222222222222222222222 | | | | | | | | | | | | | | |
| 00006300000000010 T 000063000000010 T 000063000000000010 T 000006300000000000 T 0000630000000000 T 0000630000000000 F 000063000000000 F 000063000000000 F 00000000000000 F 0000000000 | | | | | | 1 2 | | | | | | | | |
| 0000080000000000 I 222222222222222222222 | | | | | | achel | 2) | Iddres | 9 13 | : Line | ar | | | |
| 0000050000000000 I 200000000000000000000 | | | | | | 00000 | 0000 | 000000 | 2000 | | | ••••• | | |
| 0000080000000030 I P222222222222222222222222222222222222 | | | | 2000000 | 0000 | 22222 | 0000 | 0000000 | 2000 | 20 | | ••••• | | |
| Data Hindow 1 Vscu: Newritic Address is Incor 000000000000000 0F //SCREEGS-0H Bal/726/2016F27 Intil 10. Korld from 0000000000000000 0F //SCREESS-0H Bal/726/2016F27 Intil 10. Korld from 000000000000000 0F //SCREESS-0H Bal/726/2016F3 Intil 10. Korld from 000000000000000 0F //SCREESS-0H Bal/726/2016F3 Intil 10. Korld from 0000000000000000 00000000000000 Intil 10. Korld from | | | | 222222 | 2222 | 22222 | 2222 | 222222 | 2222 | 22 | | | | |
| 0000080000000000 BF5/20676c6c6548 BaBF/26520646c72 Hello Horld from 0000080000000010 BB55851446585420 000000000656668 IheHachine 00000800000000020 000000000000000000000 | | | | | | | top | Addro | | Line | 20 | | | |
| 0000080000000010 <u>BBBB144666894920</u> 000000006666689 TheNachine 0000080000000020 0000000000000000000000 | | | | | | | | | | | | Hello | Mor 14 | froe |
| 000008000000020 0000000000000 0000000000 | | | | | | | | | | | | | | |
| | | | | | | | | | | | | man | | |
| | | | | | | | | | | | | | | |

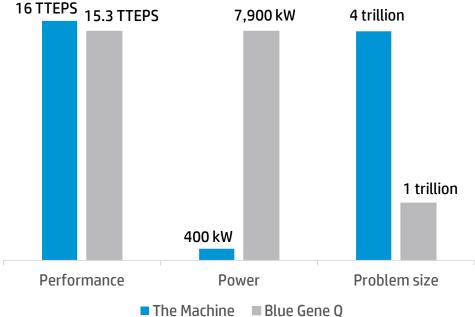
| Software | |
|-------------------|--|
| Host Linux System | |
| | |

| jizrawi@tatsd:~/tmas_run/run_0.5/checkpoint000 | - 8 |
|---|--------|
| File Edit View Search Terminal Help | |
| ROTS CONTROL - rets window control | |
| CEC - cec commands | |
| MISC - misc commands | |
| 10 - 10 commands | |
| tmas: list cpu | |
| IvyBridge 0 (cell 0, socket 0, core 0, thread 0): Status = Low Power M | ONITOR |
| address: 0x0000000001c00000 | |
| IvyBridge 2 (cell 0, socket 0, core 1, thread 0): Status = Low Power M | ONITOR |
| address: 0x00000001ba31e000 | |
| IvyBridge 32 (cell 0, socket 1, core 8, thread 0): Status = Low Power M | ONITOR |
| address: 0x00000001ba328000 | |
| IvyBridge 34 (cell 0, socket 1, core 1, thread 0): Status = Low Power M | ONITOR |
| address: 0x0000001ba32a000 | |
| IvyBridge 1024 (cell 4, socket 8, core 8, thread 8): Status = Low Power M | ONITOR |
| address: 0x0000000001c00000 | |
| IvyBridge 1026 (cell 4, socket 8, core 1, thread 0): Status = Runnable | |
| IvyBridge 1056 (cell 4, socket 1, core 8, thread 0): Status = Low Power M | ONITOR |
| address: 0x06060601ba218060 | |
| IvyBridge 1058 (cell 4, socket 1, core 1, thread 0): Status = Runnable | |
| tmas: rots data 8 -on 9x80909090900 -mem view | |
| tmas: rots data 1 -on 0x86060608080 -cache_view 2 | |
| tnas: continue | |
| Continuing all processors | |
| | |

| 1 | tmas Rots Wi | ndow 3462/h | ome/jlzra | wi/tmas_run/i | run_0.5/checkp | oint000 | _ D × |
|-------|---|-------------|--------------------|---------------|----------------|--------------------|------------|
| es F | ile | | | | ESC fo | r menu; '? | ' for help |
| | General Regist | сгз | | | | | |
| 000 | 000000000000000000000000000000000000000 | x 00000000 | 0000000 | 1 式 00007f | 4b5b65a5f0 | dx 0000000 | 000000000 |
| | | 00007fff | | | | | 000000001 |
| | |)9 fefefefe | | | | | 000000246 |
| | 000000004005d0 | | a1947f1 | 000000 | 0000000000000 | i E 0000000 | 000000000 |
| | Segment Regist | | | | | | |
| 003 | | | 0000 | 0000 | HE 0000 16 | ar 0000 | 0040 |
| | Control Regist | | | | | | |
| cr | | | | 07f4b5b65a3 | | 00000002b | |
| cr | | | 8 000 | 000000000000 | 000 mxear | 0 | 0001f80 |
| xer | se = 0x0000000 | | 2000000 | 004007-0 | #1.000 - | 0x00000000 | 00000202 |
| | ocessor 1058 | | 20000000 PL = 3 | SMN = No | | 64-bit | 00000202 |
| | | > POP | RBX | JPIN - NC | moue - | 04 010 | |
| | 00000004007e1 | RET | inero, | | | | |
| | 00000004007e2 | PUSH | RBP | | | | |
| 0000 | 00000004007e3 | MOV | RBP. | RSP | | | |
| 0000 | 00000004007e6 | PUSH | RBX | | | | |
| 0000 | 00000004007e7 | MOV | RAX, | 0xffffffff | TTTTTTTT | | |
| 0000 | 0000004007F1 | MOV | RBX, | RCX | | | |
| 0000 | 0000004007f4 | SimApi | SEQ1 | | | | |
| | 00000004007f8 | SimApi | SEQ2 | | | | |
| | 00000004007fc | SimApi | 0×0f | | | | |
| | 000000400800 | POP | RBX | | | | |
| | 0000000400801 | POP | RBP | | | | |
| | 000000400802 | RET | | | | | |
| | 0000000400803 | NOP | | | | | |
| | 0000000400804 | NOP | | | | | |
| | 0000000400805 | NOP | | | | | |
| | 0000000400806 | NOP | | | | | |
| | 0000000400807 | NOP | | | | | |
| | 0000000400808 | NOP | | | | | |
| | Data Window 0 | | Mennis | tor Addre | ess is Linea | | |
| | 000000000000000000000000000000000000000 | | | 6d6f726620 | | | orld from |
| | 0080000000010 | | | 0000000000 | | TheMac | |
| | 080000000020 | 000000000 | | | | monde | |
| 0000 | 08000000030 | 000000000 | 0000000 | 0000000000 | 0000000 | | |
| | Data Window 1 | | Cache C | | is is: Linea | r | |
| 0000 | I 000000000080 | 7????????? | | ???????????? | 1777777 | | |
| 0000 | 0080000000010 T | 222222 | 7777777 | ??????????? | 1777777 | | |
| 0000 | 0080000000020 I | 177777777 | 7777777 | ??????????? | 1777777 | | |
| :0000 | I 0600000000000000 | 222222222 | 2222222 | 222222222222 | 22222 | | |

Performance estimates – graph traversal

What could you do if you could traverse 16 trillion graph edges per second?



Graph 500-like workload

Sequoia, Blue Gene Q at Livermore

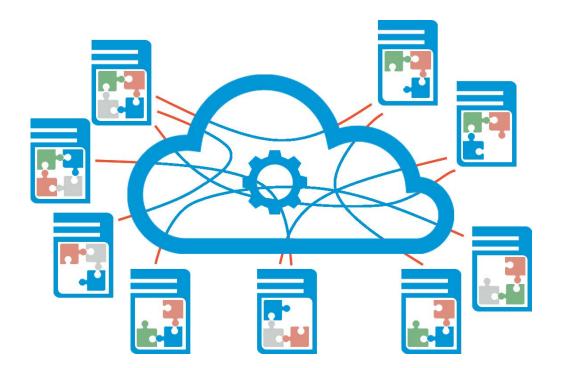
64,000 nodes, > 1M cores total

HP – The Machine

20 racks, 256 SoCs / rack, 122k cores total

256 GB NVM per SoC, 1.3 PB total 256 NICs per rack, 2*100 Gbps links / NIC Utilization < 70%

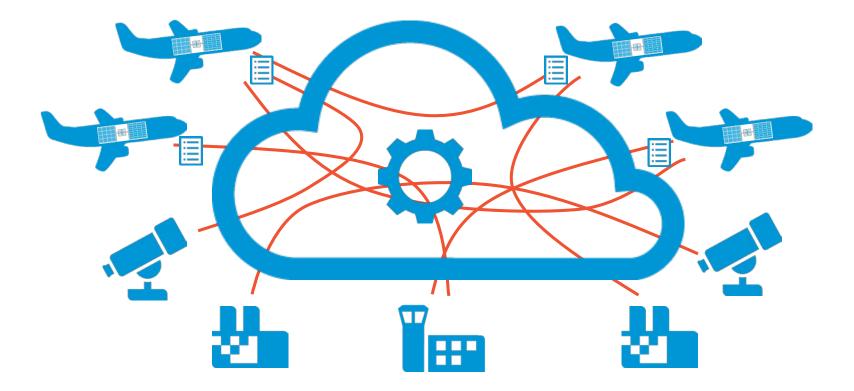




Translator Coordinator Orchestrator Arbitrator Aggregator Replicator Anonymizer **Border guard** Learning engine

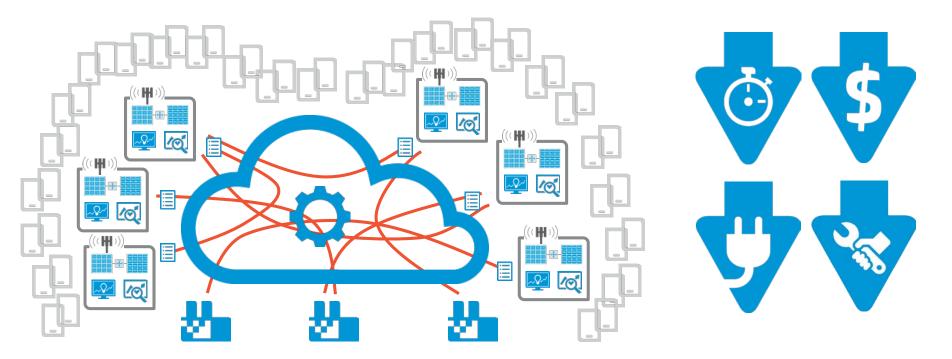


A mesh of connected aircraft ...





Use case: the smart cell tower





Future History

| ·UUI- | •UUL+ •UUL+ | | | | |
|-------------|-------------|--|--|--|--|
| •MU+ •MU+ | •UUL+ •UUL+ | | | | |
| •UUL+ •UUL+ | •UUL+ •UUL+ | | | | |
| •UUL+ •UUL+ | •UUL+ •UUL+ | | | | |

- Memristors begin sampling
- Physical infrastructure of Core prototypes established
- Open Source Machine OS SDK and emulators released
- ISV Partner collaborations begin

2015

- Edge devices begin sampling
- Machine OS enters public beta

2017

- Core devices at volume
- Machine available as product, service, and as a business process transformation

2019

 Memristor media controller, protocols and standards established

> SoC Partners selected for co-development

2014

 Machine OS development begins Memristor DIMMs launched

2016

 Integrated core technologies demonstrated • Edge devices ship in volume

2018

- Core Machines running real-world workloads at scale
- Machine OS released

• Distributed mesh cloud goes mainstream

2020



This changes everything





The Machine

Resources to share with customers

The Machine External Webpage

The Machine (German) 3 min video

The Machine classic 3 min video

Memristor Lab Tour

Photonics Lab Tour

HP Analytics Lab

HP Security and Cloud Lab

