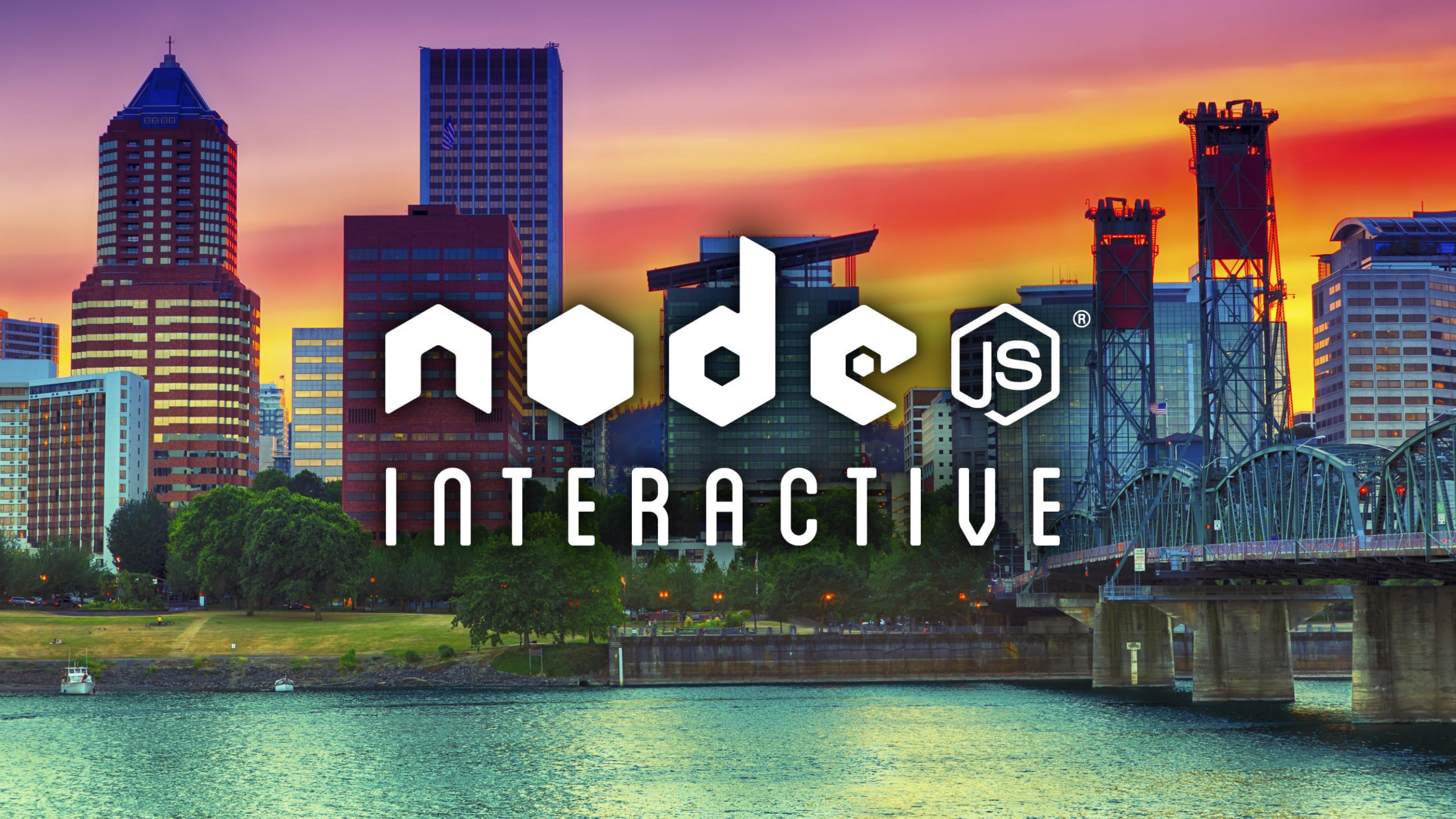
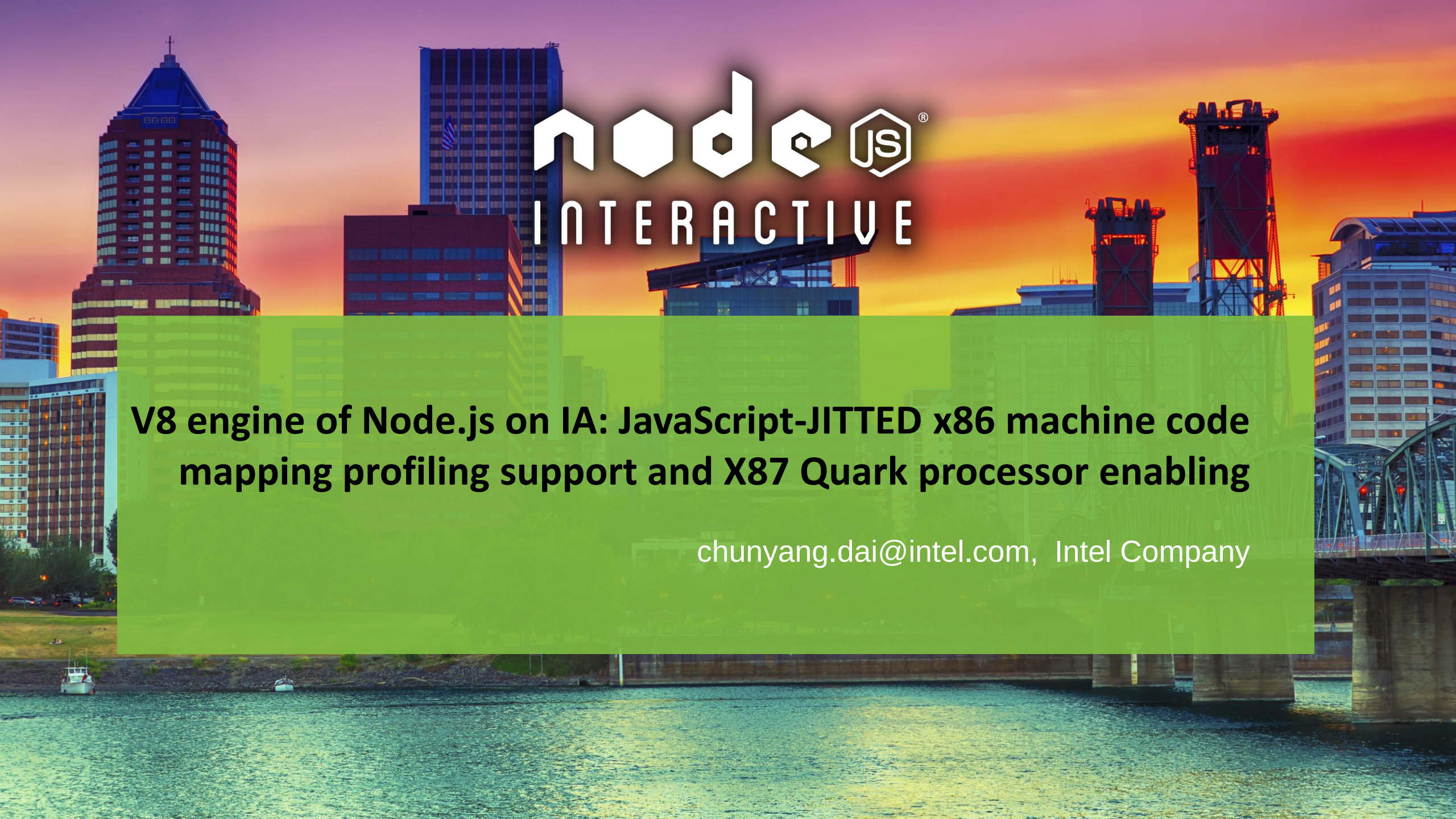

node JS®
INTERACTIVE



V8 engine of Node.js on IA: JavaScript-JITTED x86 machine code mapping profiling support and X87 Quark processor enabling

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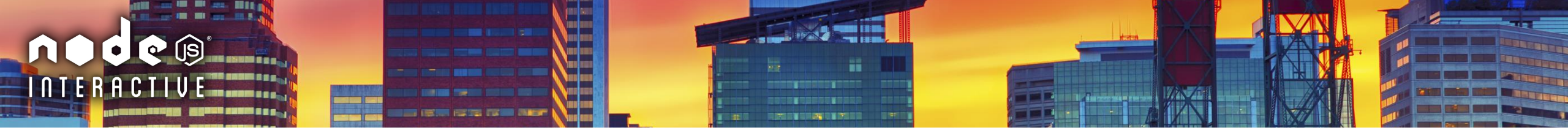
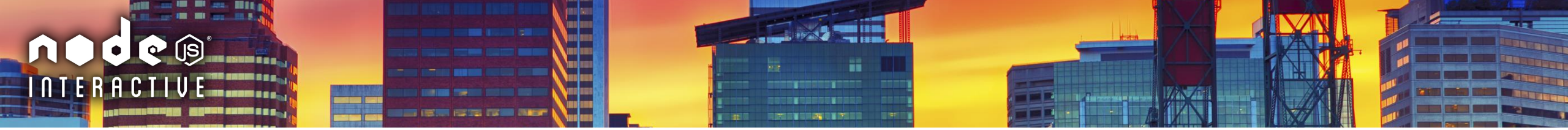


Agenda

- **JavaScript-JITTED x86 machine code mapping profiling support in VTune**
  - **Background: Scan of current profiling tools for Node.js**
  - **What's Intel VTune and and the JavaScript code / machine code mapping**
  - **How to use it in Node.js**
- X87 Quark processor enabling for V8 / Node.js
  - Background
  - Intel's effort for X87 Quark processor enabling
  - How to build Node.js for Quark processor
- Q / A?



Scan of Current Node.js profiling for JavaScript code

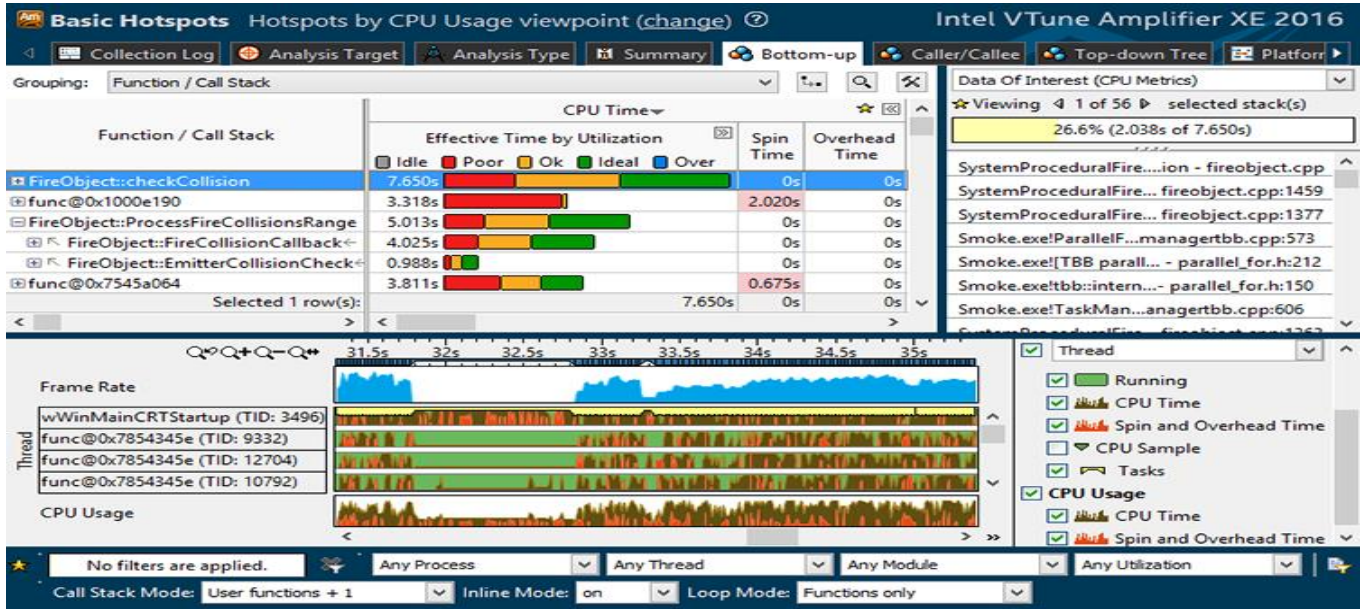
- **Existing Hierarchy of Node.js profiling**
  - Node.js' C++ level profiling – any platform-dependent profiling tool works
  - Node.js' V8 profiling with limited JavaScript function information
    - Pass "--prof" flag to node and generate the V8 log file
      - Provided function level profiling data.
      - No detailed profiling information for JavaScript code
    - "perf" and v8 "--ll_prof" support on Linux etc
      - Provided function level profiling data.
      - Provided machine code level profiling data
      - No detailed profiling information for JavaScript code
- **A big missing**
  - Node.js' V8 profiling with detailed JavaScript source code mapping to JITTED assemble machine code

```
[JavaScript]:
  ticks  total  nonlib   name
  2065   10.9%   11.1%  LazyCompile: *montReduce crypto.js:583:20
  1484    7.8%    8.0%  LazyCompile: *lin_solve navier-stokes.js:128:23
  1307    6.9%    7.0%  LazyCompile: *Scheduler.schedule richards.js:188:41
  1058    5.6%    5.7%  LazyCompile: *bnpSquareTo crypto.js:431:21
   646    3.4%    3.5%  LazyCompile: *one_way_unify1_nboyer earley-boyer.js:3635:37
   620    3.3%    3.3%  LazyCompile: *rewrite_nboyer earley-boyer.js:3604:30
   523    2.8%    2.8%  LazyCompile: *Plan.execute deltablue.js:773:35
   464    2.4%    2.5%  LazyCompile: *GeneratePayloadTree splay.js:49:29
   414    2.2%    2.2%  LazyCompile: *HandlerTask.run richards.js:465:38
   405    2.1%    2.2%  LazyCompile: *SplayTree.splay_ splay.js:293:38
   323    1.7%    1.7%  LazyCompile: *loop2 earley-boyer.js:4272:65
   301    1.6%    1.6%  LazyCompile: *loop3 earley-boyer.js:4286:85
   286    1.5%    1.5%  LazyCompile: *Flog.RayTracer.Shape.Sphere.intersect raytrace.js:426:24
   270    1.4%    1.5%  LazyCompile: *Flog.RayTracer.Engine.rayTrace raytrace.js:709:23
   262    1.4%    1.4%  LazyCompile: *Constraint.satisfy deltablue.js:172:41
   246    1.3%    1.3%  LazyCompile: *montMulTo crypto.js:606:19
   244    1.3%    1.3%  LazyCompile: *Flog.RayTracer.Vector.normalize raytrace.js:235:25
   232    1.2%    1.3%  LazyCompile: *exec native regexp.js:88:22
   191    1.0%    1.0%  LazyCompile: *deriv_trees earley-boyer.js:4254:43
   180    0.9%    1.0%  LazyCompile: *advect navier-stokes.js:204:20
   176    0.9%    0.9%  LazyCompile: *sc_loop1_98 earley-boyer.js:4258:251
   143    0.8%    0.8%  LazyCompile: *bnpFromString crypto.js:203:23
```

```
Ticks per symbol:
   194079   9.6% LazyCompile:*montReduce crypto.js:583 [js]
         0.02 0: 55                       push   ebp
         0.01 1: 89 e5                    mov    ebp,esp
              3: 56                       push   esi
         0.01 4: 57                       push   edi
              5: 83 ec 68                 sub    esp,0x68
              8: c7 45 f4 00 00 00 00     mov    DWORD PTR [ebp-0xc],0x0
              f: 8b 45 fc                 mov    eax,DWORD PTR [ebp-0x4]
             12: 89 45 f0                 mov    DWORD PTR [ebp-0x10],eax
             15: 89 c6                    mov    esi,eax
             17: 3b 25 4c 87 ea 08        cmp    esp,DWORD PTR ds:0x8ea874c
             1d: 73 05                    jae    0x24
             1f: e8 bc 96 99 d4           call   0xd49996e0
             24: 8b 5d 08                 mov    ebx,DWORD PTR [ebp+0x8]
             27: f7 c3 01 00 00 00        test   ebx,0x1
             2d: 0f 84 37 80 f3 dd        je     0xddf3806a
             33: 81 7b ff 8d 16 f1 2b     cmp    DWORD PTR [ebx-0x1],0x2bf1168d
         0.02 3a: 0f 85 34 80 f3 dd       jne    0xddf38074
             40: 8b 7b 0b                 mov    edi,DWORD PTR [ebx+0xb]
             43: 89 7d ec                 mov    DWORD PTR [ebp-0x14],edi
             46: 8b 45 0c                 mov    eax,DWORD PTR [ebp+0xc]
             49: f7 c0 01 00 00 00        test   eax,0x1
```

Intel VTune profiler and JITTED code mapping

- **What's Intel VTune profiler?**
  - A commercial application for software performance analysis.
  - It has both GUI and command line interfaces.
  - It is available for Linux, Windows and Android operating systems.
  - It provides functionality(API) to profile runtime generated code.
  - It runs on top of Intel processors (please visit Intel VTune Amplifier for details)



- **VTune's JITTED code and source code mapping API:**
  - Easy to use.
  - Provide detailed dynamic generated code line <-> machine code level profiling/mapping capacity

Enable Node.js' JavaScript-JITTED x86 machine code mapping profiling support in VTune

- **Upstream Status:**
  - This feature is landed in Node.js by pull request #3785.
  - Thanks for Ben Noordhuis and others' timely review
  - It should be available since Node.js V5.2.0.
- **How to build a Vtune-enable Node.js:**
  - Step 1: Download Node.js code from github.
  - Step 2: Compile Node.js with special flag:

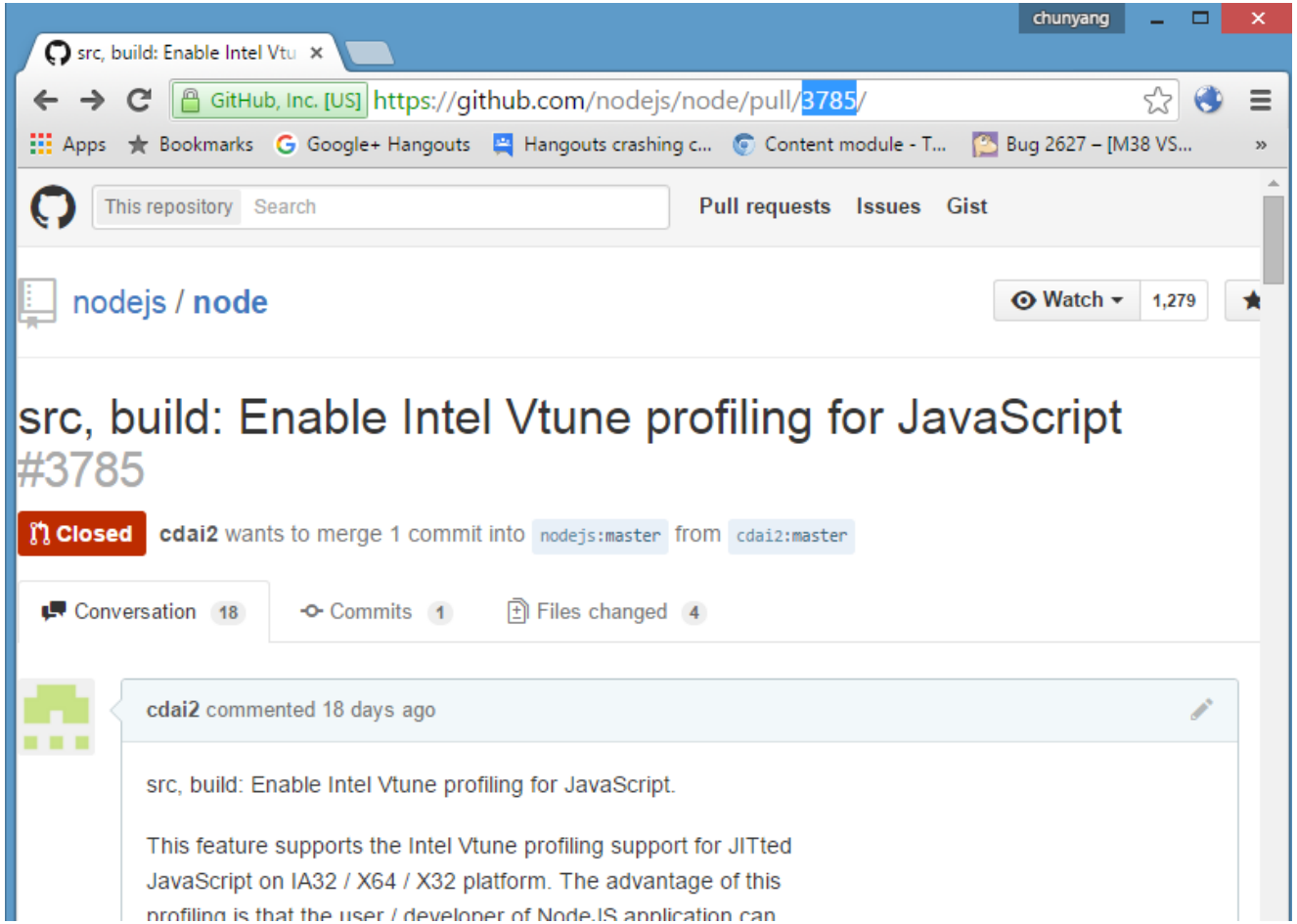
    on Windows OS:

    ./vcbuild.bat –enable-vtune [other flags]

    on Linux and android:

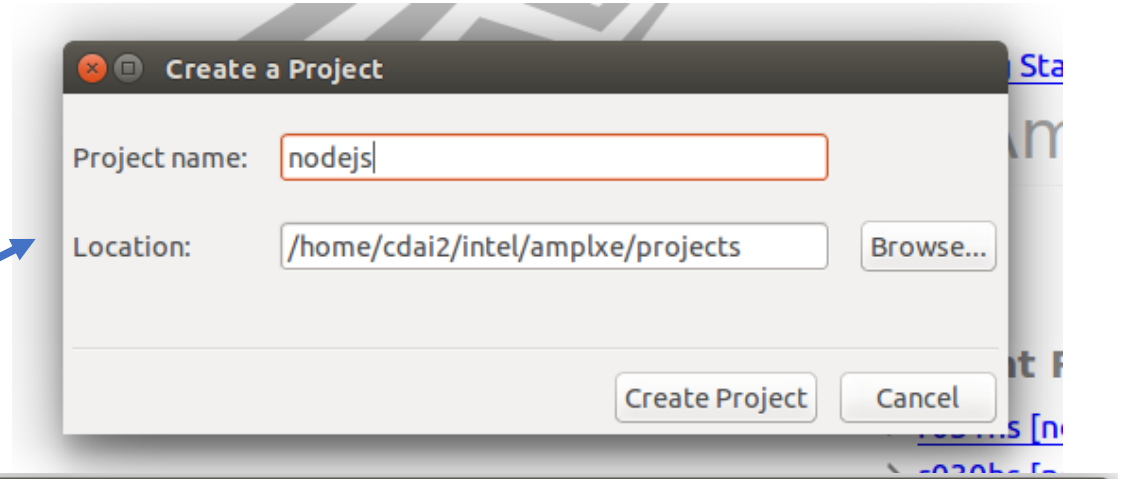
    ./configure –enable-vtune-profiling [other flags]

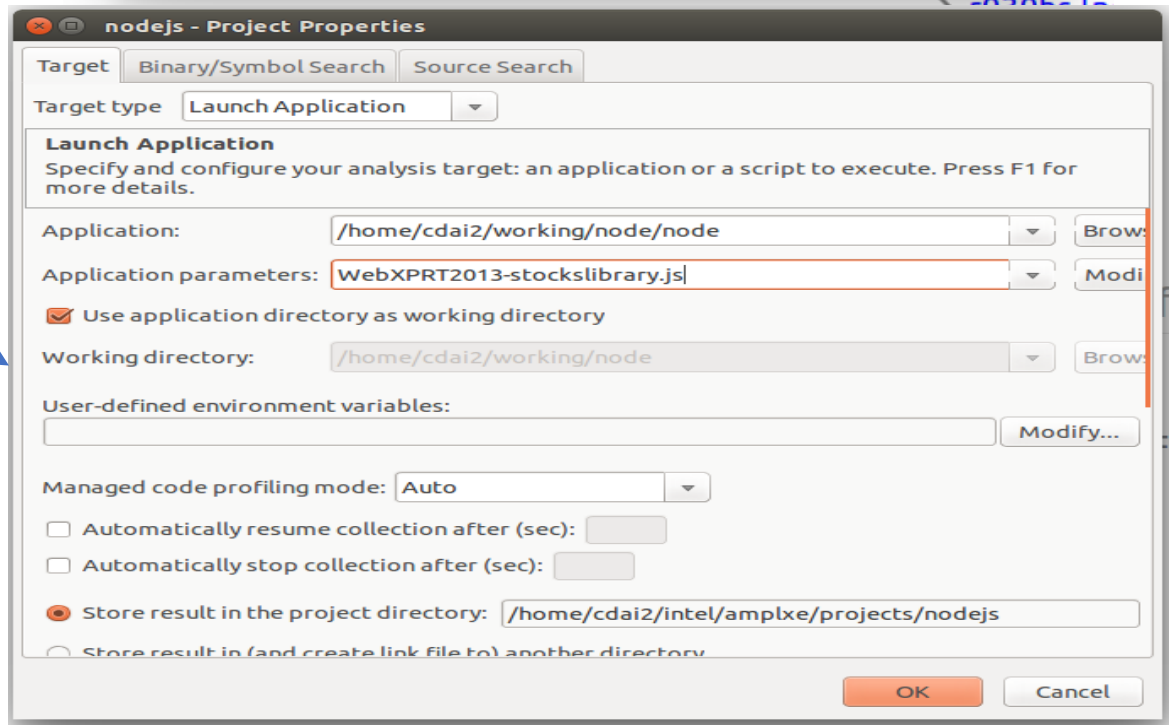
    ./make



Profile JavaScript in Vtune (1)

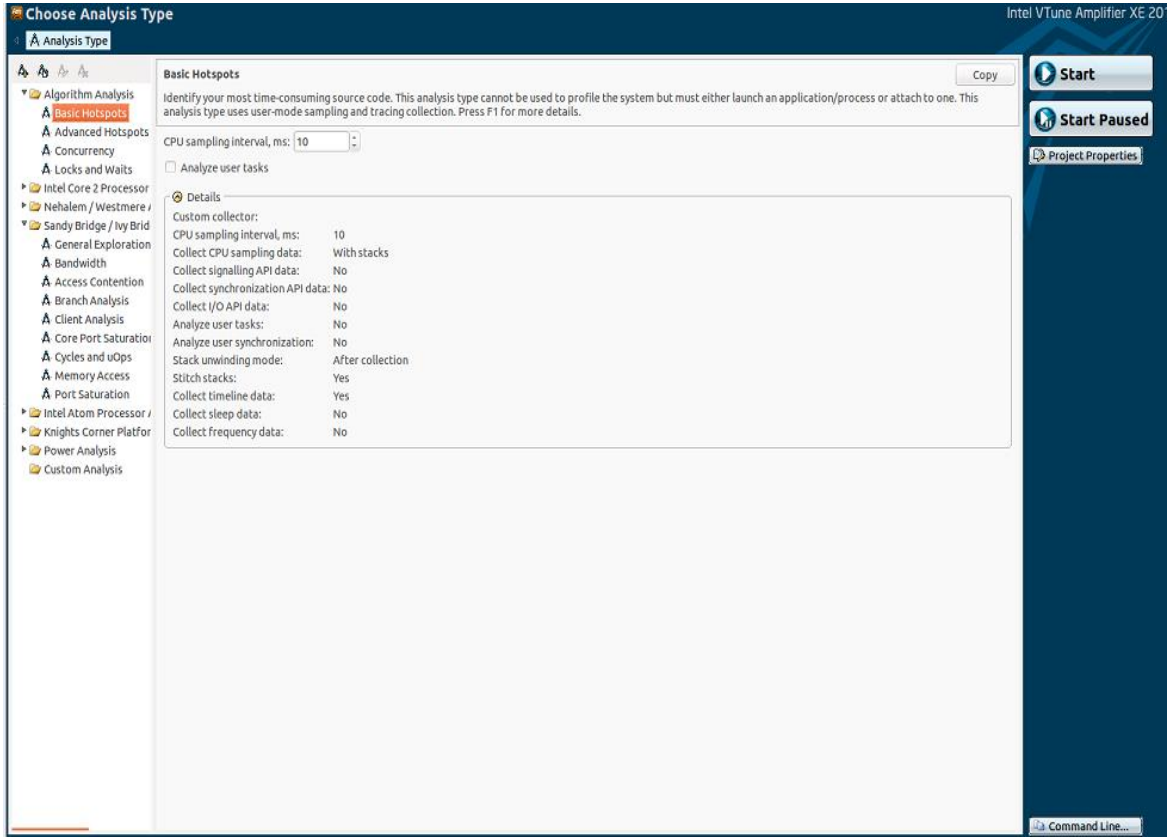
- **How to do Node.js profiling in Vtune:**
  - Step 1 : Get/Install Vtune .
  - Step 2 : Open Intel VTune and create one project in it.
  - Step 3 : Configure VTune project.



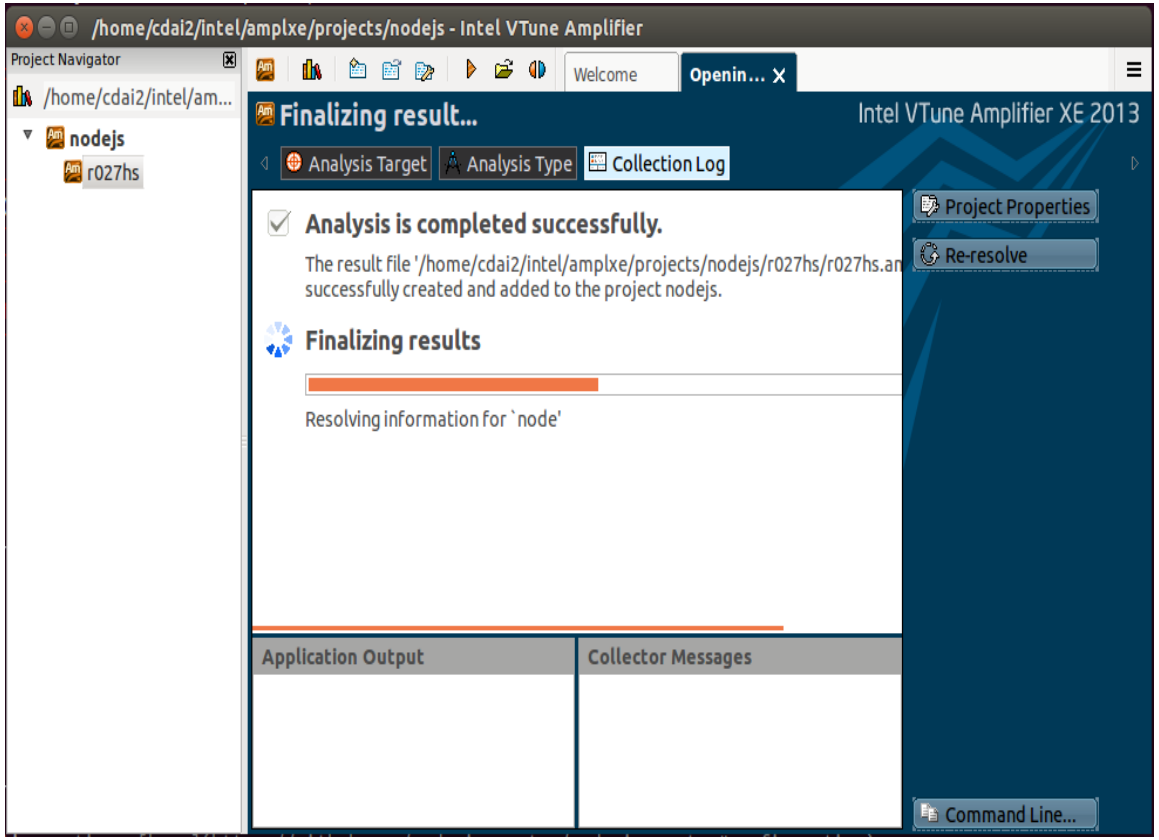


Profile JavaScript in Vtune (2)

- Step 4 : configure profiling type and start profiling

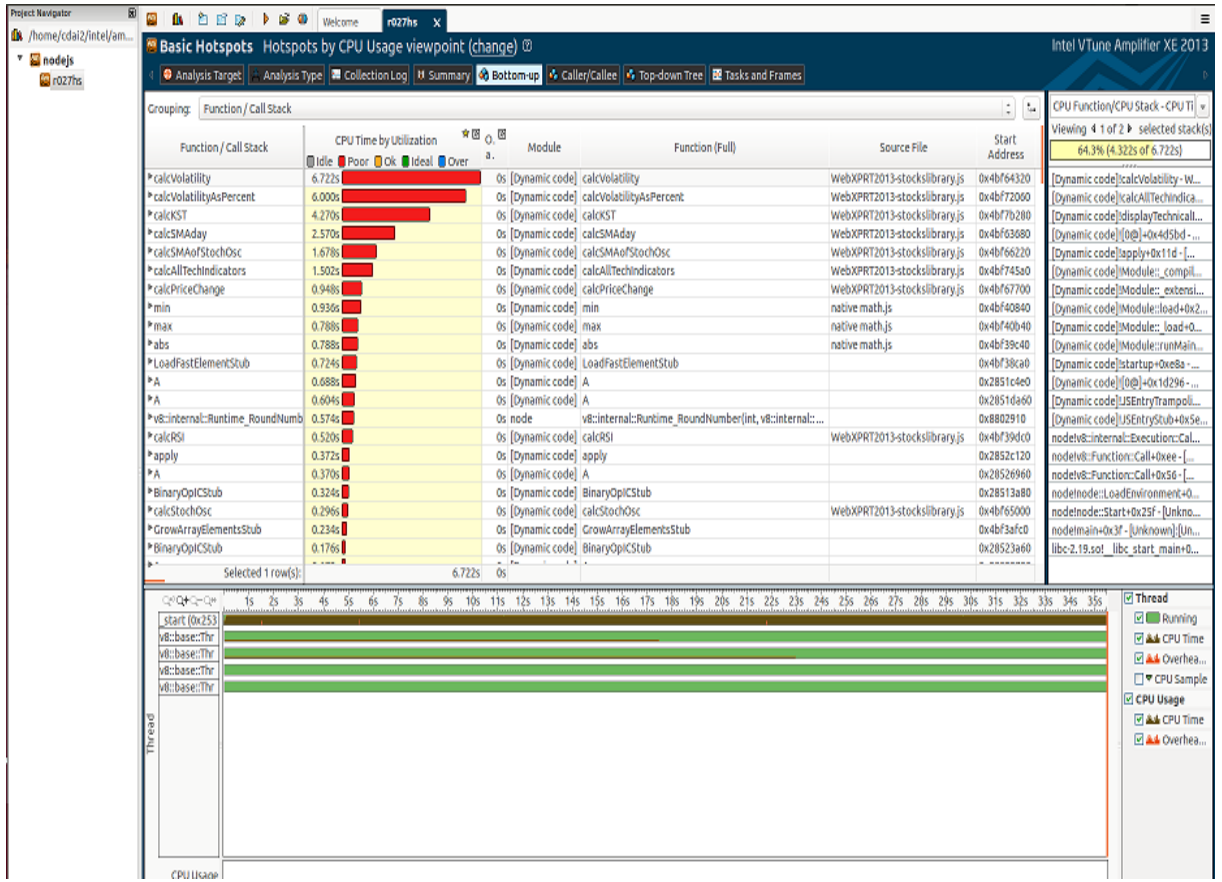


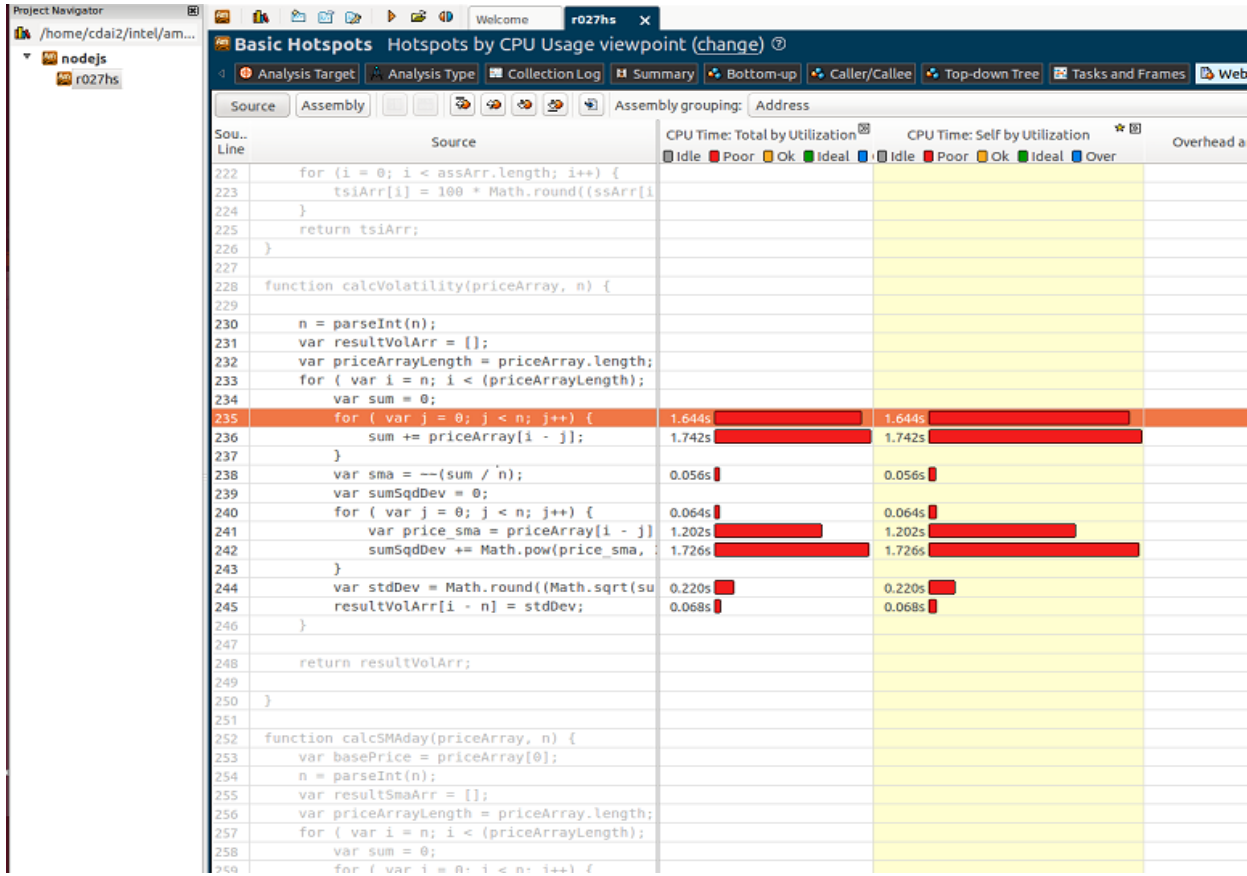
- Step 5: show result do analysis.



Profile JavaScript in Vtune (3)

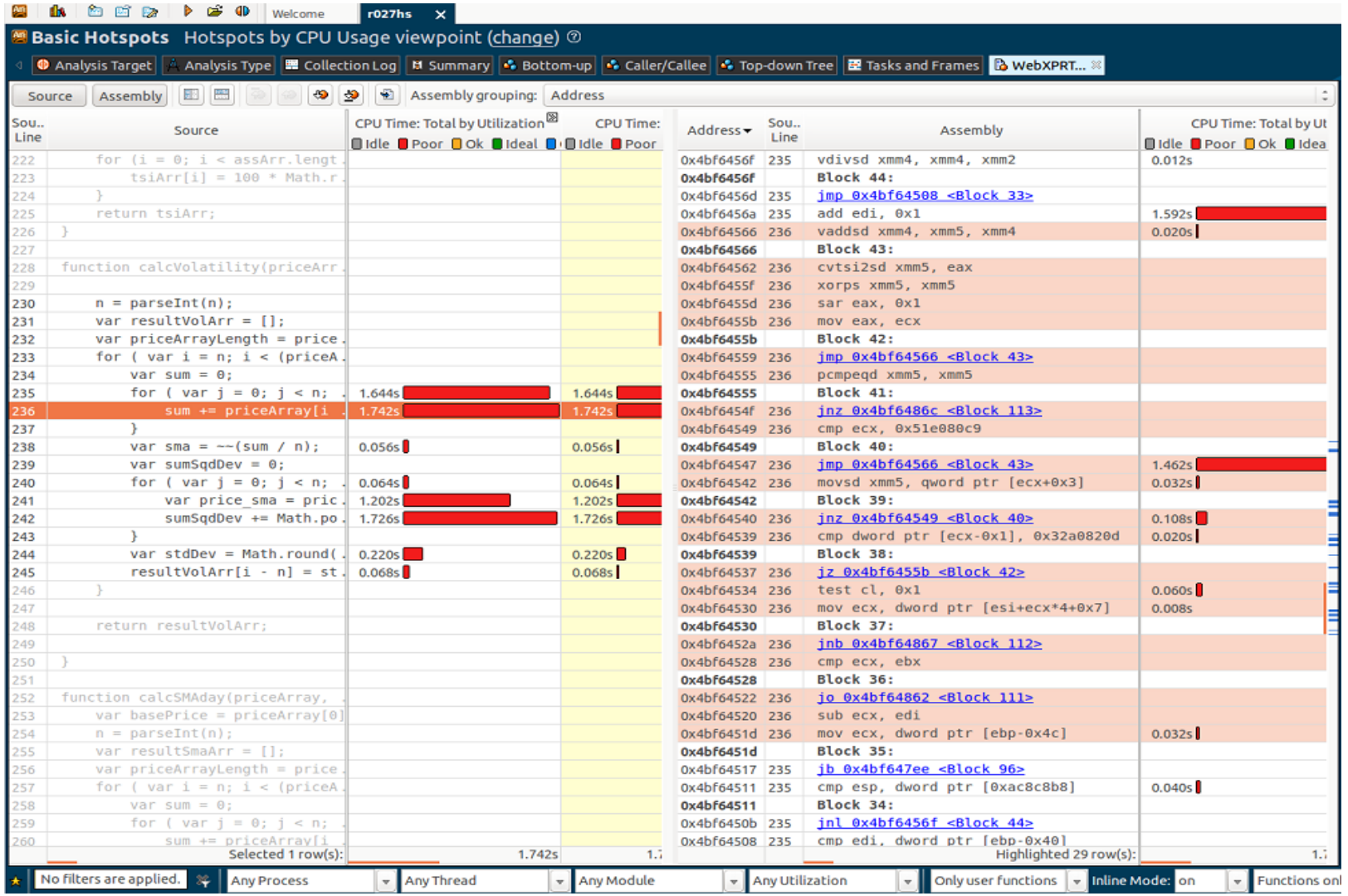
- Step 5: show result do analysis.

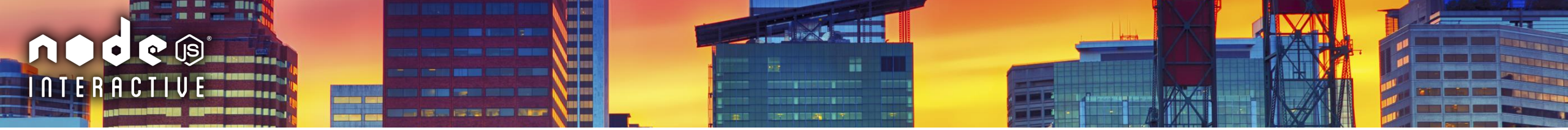




Profile JavaScript in Vtune (4)

- Step 5: show result do analysis.





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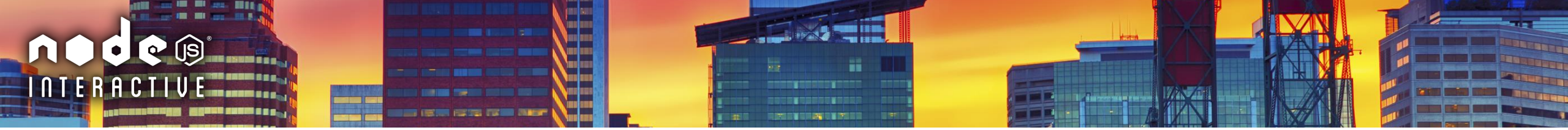
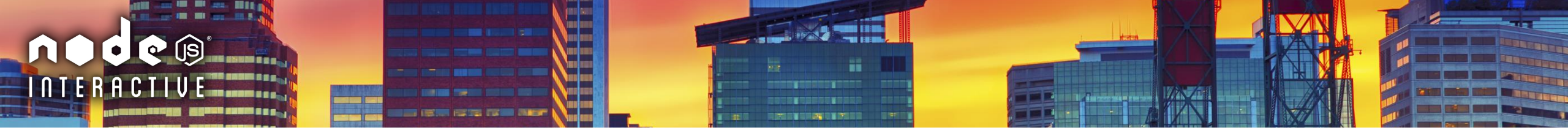


X87 Quark processor enabling for V8 / Node.js

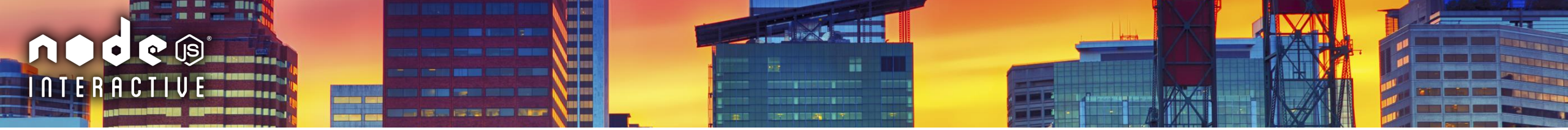
- **Background**
  - **Intel X87:**
    - x87 is only floating point ISA of the x86 architecture instruction set **before** SSE debut
    - x87 co-exist with SSE enable processor
  - **Intel Quark Family processor :**
    - Quark processor is designed for ubiquitous computing markets and the Internet of Things (IoT), from automotive to industrial to wearables
    - Quark processor's float point currently is x87-only ISA
  - **Google V8's original roadmap of IA32 support :**
    - SSE/none-SSE V8 co-existing in unified IA32/X64 V8 main port before V8 v3.26
    - SSE/none-SSE V8 port is forked since V8 3.27
      - V8 embedded applications such as Node.js needs a dedicated V8 port for X87-only platform after V8 3.26

	<= 3.26 release	> 3.26 release
With SSE2 (IA32/X64)	Yes. With optimized compilers	Yes. With optimized compilers
Non-SSE (including X87-only Quark processor)	Yes. But Low priority. No optimized compiler support.	Not in major x86 master port (Need Intel's work on X87 port)



X87 Quark processor enabling for V8 / Node.js

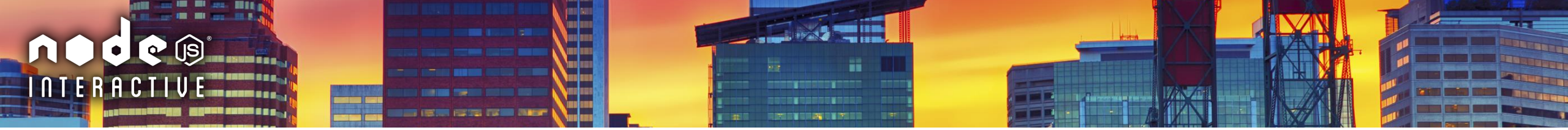
- **Intel's effort for Node.js enabling on Quark:**
  - Functionality
    - Intel created and being maintainer of V8 X87 port inside V8 upstream code repository
    - From V8 v3.27 to current V8 4.8's release branch and future V8 release branch
    - Intel is making sure every release of Node.js works well on Quark since node.js 0.12
  - Performance
    - Intel implemented optimized compilers for v8 x87: 1) **Crankshaft** compiler since V8 release v3.27 2)**Turbofan** compiler since V8 release v4.5



X87 Quark processor enabling for V8 / Node.js

- **How to build Node.js on Intel Quark processor specifically.**

Step 1: download node.js source code.
Step 2: do configuration
./configure –dest-cpu=ia32
Step 3: modify the config.gypi, add one line as below (marked Red)
'target_arch': 'ia32',
……..
'v8_no_strict_aliasing': 1,
'v8_optimized_debug': 0,
'v8_random_seed': 0,
'v8_use_snapshot': 'true',
'v8_target_arch': 'x87',
'want_separate_host_toolset': 1}}
Step 4: *./make*



Q / A.

- You can also reach me by email:
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