****

**High Performance Computing Over Google Cloud Platform**

January 2021

C:\Users\sanish.raju\Desktop\1503-1413062_Brand update template creation\13-May-2015\Letter pieces\EY Approach_2lines LETTER_proposal.wmf

Table of Contents –

iNTRODUCTION 4

HPC COMPUTING 4

ON PREMISES HPC HAS ITS LIMITS 4

CLOUD A BETTER WAY TO HPC 4

GCP DELIVER A COMPLETE HPC SOLUTION 4

DRIVING INNOVATION ACROSS INDUSTRIES 4

SUMMARY 4

|  |
| --- |
|  |

|  |
| --- |
| Apractice to build up Computing Power in a way that delivers much Higher Performance than one could get from a typical desktop computer or workstation in order to solve large problems in field of science, engineering or business.It is also referred to as Super-Computing for this reason. It enables the simulation or analysis of huge volumes of data that will otherwise not be possible to do with standard computer.High Performance Computing (HPC) has been key to solving the most complex problems in every industry, and changing the way we work and live. |

|  |
| --- |
| From weather modeling to genome mapping to the search for extraterrestrial intelligence, HPC is helping to push the boundaries of what’s possible with advanced computing technologies. Once confined to government labs, large enterprises, and select academic organizations, today it is found across a wide range of industries.In this paper we will discuss how cloud services put the world’s most advanced computing capabilities within reach for more organizations, helping them to innovate faster and gain a competitive edge. We will discuss the advantages of running HPC workloadsOn Google Cloud Platform(GCP), compared to traditional on-premises architectures. We will also illustrate these benefits in actual deployments across a variety of industries. |

**INTRODUCTION**

|  |
| --- |
| Although HPC applications share some common building blocks, they are not all similar. HPC applications are often based on complex algorithms that rely on high performing infrastructure for efficient execution.  These applications need hardware that includes high performance processors, memory, and communication subsystems. For many applications and workloads,  the performance of compute elements must be complemented by comparably high-performance storage and networking elements. Some may demand high levels of parallel processing, but not necessarily fast storage or high-performance interconnect. Other applications are interconnect-sensitive, requiring low latency and high throughput networking. Similarly, there are many I/O-sensitive applications that, without a very fast I/O subsystem, will run slowly because of storage bottlenecks. And still other applications such as game streaming, video encoding, and 3D application streaming, need performance acceleration using GPUs. Today, many large enterprises and research institutions procure and maintain their own HPC |

|  |
| --- |
| infrastructure. This HPC infrastructure is shared across many applications and groups within the organization to maximize utilization of this significant capital investment.  Cloud-based services have opened up a new frontier for HPC. Moving HPC workloads to the cloud can provide near instant access to virtually unlimited computing resources for a wider community of users, and can support completely new types of applications. Today, organizations of all sizes are looking to the cloud to support their most advanced computing applications.  For smaller enterprises, cloud is a great starting point, enabling fast, agile deployment without the need for heavy capital expenditure. For large enterprises, cloud provides an easier way to tailor HPC infrastructure to changing business needs and to gain access to the latest technologies, without having to worry about upfront investments in new infrastructure, or ongoing operational expenses. When compared to traditional  on-premises HPC infrastructures, cloud offers significant advantages in terms of scalability, flexibility, and cost. |

****

**HPC COMPUTING**



****

**HPC HAS Its LIMITS**

|  |
| --- |
| Today, on-premises HPC infrastructure handles most of the HPC workloads that enterprises and research institutions employ. Most HPC system administrators maintain and operate this infrastructure at varying levels of utilization. However, business is always competitive, so efficiency needs to be coupled with the flexibility and opportunity to innovate continuously. Some of the challenges with on-premises HPC are well known. These include long procurement cycles, high initial capital investment, and the need for mid-cycle technology refreshes. For most organizations, planning for and procuring an HPC system is a long and arduous process that involves detailed capacity forecasting and system evaluation |

|  |
| --- |
| cycles. Often, the significant up-front capital investment required is a limiting factor for the amount of capacity that can be procured. Maintaining the infrastructure over its lifecycle is an expensive proposition, as well. Previously, technology refreshes every three years was enough to stay current with the compute technology and incremental demands from HPC workloads. However, to take advantage of the faster pace of innovation, HPC customers are needing to refresh their infrastructure more often than before. And it is worth the effort. IDC reports that for every  $1 spent on HPC, businesses see $463 in incremental revenues and $44 in incremental profit, so delaying incremental investments in HPC – and thus delaying the innovations it brings – has large downstream effects on the business. |

## There are other limitations of on-premises HPC infrastructure that are less visible and so are often overlooked leading to misplaced optimization efforts.

1. Heading 1

Section leader

Subheading 1

Subheading 2

* 1. Body Text
  2. Body Text

1. EY\_num level 1
   1. EY\_num level 2
      1. EY\_num level 3
         1. EY\_num level 4
            1. EY\_num level 5

* Bullet text 1
* Bullet text 2
* Bullet text 3
* Bullet list 1
* Bullet list 2
* Bullet list 3

1. Alpha numeric bullet 1
   1. Alpha numeric bullet 2
      1. Roman Bullet

# Header 25 points

Sub head 10 points bold

Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9. Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9rowth drivers of the CV segment. Growth in road network and density has resulted in roads capturing a greater share of transportation of goods and passengers, leading to growth 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9. Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9rowth drivers of the CV segment. Growth in road network and density has resulted in roads capturing a greater share of transportation of goods and passengers, leading to growth 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9. Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 Other factors that have driven growth in the segment include:

Body copy 9 points light copy 9 points light Body copy 9 points light 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Entry of global CV manufacturers into the country and introduction of newer products and product categories light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 Other factors that have driven growth light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 Other factors that have driven growth

MHCVs account for majority share of the CV segment

CVs can be classified as light commercial vehicles (LCVs), medium commercial vehicles (MCVs), and heavy commercial vehicles (HCVs). In FY08, Medium and heavy commercial vehicles (MHCVs) together accounted for 56% of domestic sales, whereas LCVs accounted for 44%.

|  |
| --- |
| Table header |
|  |

Source: SIAM

copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 Body copy 9 points lightBody copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points

|  |
| --- |
| Table header |
|  |

Source: SIAM

copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points The existing Manesar R&D facility has developed its global car, A-Star, which is slated to debut in Europe this year.   
(Source: 8 points italics)

Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9. Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Bodyy copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points light Body copy 9 points

Pie Chart

**Note: As per new guidelines we cannot mix primary colour with secondary colour. The primary color palette can be used to visualize data when a single highlight is required (using EY Yellow).**

**And the advanced /secondary color palette is for when data is to be presented using different colors and without a highlight. The colours palates are available towards the end of this template. (You should remove the colours palates before you share the file with your clients.**

Sample table execution below

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Table XX: Comparable companies’ XYZ | | | | |
| Company name | X.XX% | Company name | X.XX% |
| Company name | X.XX% | Company name | X.XX% |
| Company name | X.XX% | Company name | X.XX% |
| Company name | X.XX% | Company name | X.XX% |
| Company name | X.XX% | Company name | X.XX% |
| Company name | X.XX% | Company name | X.XX% |
| Company name | X.XX% | Company name | X.XX% |
| Company name | X.XX% | Company name | X.XX% |
| Company name | X.XX% | Company name | X.XX% |
| Company name | X.XX% | Company name | X.XX% |
| Lower quartile | X.XX% | Lower quartile | X.XX % |
| Median | X.XX % | Median | X.XX % |
| Upper quartile | X.XX % | Upper quartile | X.XX % |

Table explanation would appear here.

Sample table execution 2

|  |  |  |  |
| --- | --- | --- | --- |
| Column heading | Column heading | Column heading | Important column |
| Lorem ipsum dolor sit amet, consectetuer adipiscing elit. Quisque faucibus feugiat tellus. | Lorem ipsum dolor sit amet, consectetuer adipiscing elit. Quisque faucibus feugiat tellus. | Lorem ipsum dolor sit amet, consectetuer adipiscing elit. Quisque faucibus feugiat tellus. | Lorem ipsum dolor sit amet, consectetuer adipiscing elit. Quisque faucibus feugiat tellus. |
| Lorem ipsum dolor sit amet, consectetuer adipiscing elit. Quisque faucibus feugiat tellus. | Lorem ipsum dolor sit amet, consectetuer adipiscing elit. Quisque faucibus feugiat tellus. | Lorem ipsum dolor sit amet, consectetuer adipiscing elit. Quisque faucibus feugiat tellus. | Lorem ipsum dolor sit amet, consectetuer adipiscing elit. Quisque faucibus feugiat tellus. |
| Lorem ipsum dolor sit amet, consectetuer adipiscing elit. Quisque faucibus feugiat tellus. | Lorem ipsum dolor sit amet, consectetuer adipiscing elit. Quisque faucibus feugiat tellus. | Lorem ipsum dolor sit amet, consectetuer adipiscing elit. Quisque faucibus feugiat tellus. | Lorem ipsum dolor sit amet, consectetuer adipiscing elit. Quisque faucibus feugiat tellus. |

Sample table execution 3

| Column one | Column two |
| --- | --- |
| Donec tellus. Maecenas mi. Sed augue. Aenean eget justo. Morbi adipiscing est quis nibh. Pellentesque sit amet libero. Mauris ac urna. Morbi blandit. |  |
| Donec tellus. Maecenas mi. Sed augue. Aenean eget justo. Morbi adipiscing est quis nibh. Pellentesque sit amet libero. Mauris ac urna. Morbi blandit. |  |
| Donec tellus. Maecenas mi. Sed augue. Aenean eget justo. Morbi adipiscing est quis nibh. Pellentesque sit amet libero. Mauris ac urna. Morbi blandit. |  |
| Donec tellus. Maecenas mi. Sed augue. Aenean eget justo. Morbi adipiscing est quis nibh. Pellentesque sit amet libero. Mauris ac urna. Morbi blandit. |  |
| Donec tellus. Maecenas mi. Sed augue. Aenean eget justo. Morbi adipiscing est quis nibh. Pellentesque sit amet libero. Mauris ac urna. Morbi blandit. |  |
| Donec tellus. Maecenas mi. Sed augue. Aenean eget justo. Morbi adipiscing est quis nibh. Pellentesque sit amet libero. Mauris ac urna. Morbi blandit. |  |
| Donec tellus. Maecenas mi. Sed augue. Aenean eget justo. Morbi adipiscing est quis nibh. Pellentesque sit amet libero. Mauris ac urna. Morbi blandit. |  |
| Donec tellus. Maecenas mi. Sed augue. Aenean eget justo. Morbi adipiscing est quis nibh. Pellentesque sit amet libero. Mauris ac urna. Morbi blandit. |  |
| Donec tellus. Maecenas mi. Sed augue. Aenean eget justo. Morbi adipiscing est quis nibh. Pellentesque sit amet libero. Mauris ac urna. Morbi blandit. |  |
| Donec tellus. Maecenas mi. Sed augue. Aenean eget justo. Morbi adipiscing est quis nibh. Pellentesque sit amet libero. Mauris ac urna. Morbi blandit. |  |

Sample CV format

Type your text

Type your text

* Type your text
* Type your text

**Hyderabad**

THE SKYVIEW 10

18th Floor, "Zone A"

Survey No 83/1, Raidurgam

Hyderabad – 500032

Tel: + 91 40 6736 2000

**Jamshedpur**

1st Floor, Shantiniketan Building

Holding No. 1, SB Shop Area

Bistupur, Jamshedpur – 831 001

Tel: + 91 657 663 1000

**Kochi**

9th Floor, ABAD Nucleus

NH-49, Maradu PO

Kochi - 682 304

Tel: + 91 484 433 4000

**Kolkata**

22 Camac Street

3rd Floor, Block ‘C’

Kolkata - 700 016

Tel: + 91 33 6615 3400

**Mumbai**

14th Floor, The Ruby

29 Senapati Bapat Marg

Dadar (W), Mumbai - 400 028

Tel: + 91 22 6192 0000

5th Floor, Block B-2

Nirlon Knowledge Park

Off. Western Express Highway

Goregaon (E)

Mumbai - 400 063

Tel: + 91 22 6192 0000

**Pune**

C-401, 4th floor

Panchshil Tech Park

Yerwada

(Near Don Bosco School)

Pune - 411 006

Tel: + 91 20 4912 6000

**Ahmedabad**

22nd Floor, B Wing, Privilon,

Ambli BRT Road, Behind Iskcon   
Temple, Off SG Highway,   
Ahmedabad - 380 015

Tel: + 91 79 6608 3800

**Bengaluru**

6th, 12th & 13th floor

“UB City”, Canberra Block

No.24 Vittal Mallya Road

Bengaluru - 560 001

Tel: + 91 80 6727 5000

Ground Floor, ‘A’ wing

Divyasree Chambers

# 11, O’Shaughnessy Road

Langford Gardens

Bengaluru - 560 025

Tel: + 91 80 6727 5000

**Chandigarh**

1st Floor, SCO: 166-167

Sector 9-C, Madhya Marg

Chandigarh - 160 009

Tel: + 91 172 331 7800

**Chennai**

Tidel Park, 6th & 7th Floor

A Block, No.4, Rajiv Gandhi Salai

Taramani, Chennai - 600 113

Tel: + 91 44 6654 8100

**Delhi NCR**

Golf View Corporate Tower B

Sector 42, Sector Road

Gurgaon - 122 002

Tel: + 91 124 443 4000

3rd & 6th Floor, Worldmark-1

IGI Airport Hospitality District

Aerocity, New Delhi - 110 037

Tel: + 91 11 4731 8000

4th & 5th Floor, Plot No 2B

Tower 2, Sector 126

NOIDA - 201 304

Gautam Budh Nagar, U.P.

Tel: + 91 120 671 7000

**Our offices**

Ernst & Young LLP

**EY** | Assurance | Tax | Strategy and Transactions | Consulting

**Note: Please delete the colour pallet before sharing the   
file with client**

201 – 129 - 178

177 – 72 - 145

146 – 43 - 115

117 – 14 - 92

90 – 10 – 66

66 – 21 – 45

53 – 28 - 33

255 – 154 – 145

255 – 115 - 106

249 – 93 - 84

255 – 65 - 54

224 – 54 - 44

185 – 37 - 28

122 – 19 - 13

255 – 180 – 106

255 – 152 – 49

255 – 129 – 10

255 – 109 – 0

247 – 105 – 0

235 – 79 - 0

188 – 47 – 0

140 – 232 - 173

87 – 225 - 136

52 – 199 - 104

45 – 183 - 87

24 – 157 - 62

22 – 135 - 54

19 – 101 – 42

147 – 240 – 230

96 – 230 - 225

66 – 201 - 194

39 – 172 – 170

16 – 144 – 144

13 – 117 – 117

0 – 79 – 79

135 – 211 – 242

78 – 190 – 235

53 – 164 - 232

24 – 140 - 229

23 – 119 – 207

21 – 92 – 180

8 – 44 – 101

156 - 130 - 212

114 – 75 – 195

84 – 46 – 165

61 – 16 – 138

36 – 13 – 117

10 – 9 - 90

21 – 23 – 62

255 – 230 - 0

46 – 46 - 56

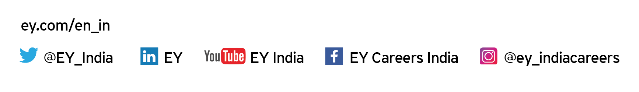
116 – 116 - 128

196 – 196 - 205

246 – 246 - 250

**Colour with RGB value**

**Colour with RGB value**



About EY

EY is a global leader in assurance, tax, strategy, transaction and consulting services. The insights and quality services we deliver help build trust and confidence in the capital markets and in economies the world over. We develop outstanding leaders who team to deliver on our promises to all of our stakeholders. In so doing, we play a critical role in building a better working world for our people, for our clients and for our communities.

EY refers to the global organization, and may refer to one or more, of the member firms of Ernst & Young Global Limited, each of which is a separate legal entity. Ernst & Young Global Limited, a UK company limited by guarantee, does not provide services to clients. Information about how EY collects and uses personal data and a description of the rights individuals have under data protection legislation are available via ey.com/privacy. For more information about our organization, please visit ey.com.

Ernst & Young LLP is one of the Indian client serving member firms of EYGM Limited. For more information about our organization, please visit www.ey.com/en\_in.

Ernst & Young LLP is a Limited Liability Partnership, registered under the Limited Liability Partnership Act, 2008 in India, having its registered office at 22 Camac Street, 3rd Floor, Block C, Kolkata – 700016

© 2020 Ernst & Young LLP. Published in India.   
All Rights Reserved.

ED None

This publication contains information in summary form and is therefore intended for general guidance only. It is not intended to be a substitute for detailed research or the exercise of professional judgment. Neither EYGM Limited nor any other member of the global Ernst & Young organization can accept any responsibility for loss occasioned to any person acting or refraining from action as a result of any material in this publication. On any specific matter, reference should be made to the appropriate advisor.