

## Curriculum Vitae for Eric J. Lingerfelt

President

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### **Summary**

As President of Pandia Software, LLC, I manage, design, develop, and spearhead the application of robust, innovative software technologies facilitating scientific data discovery, visualization, management, and calculation by integrating cutting-edge computing platforms with intuitive user experiences. The core vision of Pandia Software is to provide our customers with powerful tools to greatly reduce their "Time to Science" and to support their mission by delivering high-quality, well-maintained software application systems tailored to their needs. At Pandia, we specialize in multiple facets of modern data-centric workflows including semantic web discovery and access, customizable visualization tools, intuitive user interfaces, large-scale data management, HPC and cloud integration, and complex, automated workflow engines.

As a software engineer, developer, architect with an educational background in astrophysics and mathematics, I specialize in the design, development, and deployment of full stack application systems for research and development in the public and private sectors. These award-winning systems utilize intuitive user interfaces, relational databases, advanced visualization technologies, and secure web services that seamlessly integrate with scalable data formats, high performance computing simulations, cloud platforms, big data analytics applications, and petabyte-scale storage systems. The resulting software solutions provide highly interactive user experiences that enable scientists to generate, access, discover, analyze, visualize, manipulate, and share complex sets of data from anywhere in the world in near real-time. For over 15 years, I have led and collaborated with teams comprised of prominent domain experts and computing professionals to implement, and successfully deliver, multiple n-tier software systems to the US DOE and the NSF in a wide variety of fields, which include nuclear astrophysics, nanoscale materials science, Earth science, Big Bang cosmology, supernovae modeling, environmental science, and isotope sales and distribution.

### **Education**

- M.S. in Physics with a concentration in Astrophysics (2002), University of Tennessee at Knoxville.
- B.S. in Mathematics and Physics (1998), East Tennessee State University.

### **Research and Professional Experience**

- President, Pandia Software, LLC (2017-present).
- EarthCube Technical Officer / Software Engineer IV, University Corporation for Atmospheric Research (2017-2019).
- Technical Staff Member / Software Engineer III, Computer Science and Mathematics Division, ORNL (2009-2017).
- IT Specialist II, Department of Physics and Astronomy, University of Tennessee, Knoxville (2003-2009).
- Consultant, Hecate Software, Inc. (2007-2009).
- Software Developer, T N & Associates, Inc. (2007).

- Consultant, Strategic Environmental Research and Development Program, Environmental Sciences Division, ORNL (2005-2006).
- Consultant, LightCone Interactive, LLC (2001-2002).
- Graduate Research Assistant, Department of Physics and Astronomy, University of Tennessee, Knoxville (2001-2002).
- Graduate Teaching Assistant, Department of Physics and Astronomy, University of Tennessee, Knoxville (1998-2001).
- Undergraduate Researcher, Southeastern Association for Research in Astronomy (1997).

### Media Releases

- "ORNL System Unites Imaging and Computing in the Search for New Materials", ORNL Review, Vol. 50, No. 1, 2017 (<https://www.ornl.gov/content/ornl-review-v50n1>)
- "CADES: A New Environment for Scientific Discovery", July 13, 2017 (<https://youtu.be/NIqt3mlugRU>)
- "The Beam Software System", April 5, 2017 (<https://youtu.be/UujNVr2KZ9Q>)
- "An Accelerated Pipeline to Open Materials Research", July 21, 2016 (<https://www.ornl.gov/news/accelerated-pipeline-open-materials-research>)

### Software Projects

- **Bellerophon** (2009-present / Software Architect / Lead Developer) - A computational workflow environment for real-time analysis, data management, and software engineering of HPC core-collapse supernovae simulations for the DOE Advanced Scientific Computing Research Program and the National Center for Computational Sciences. Bellerophon seamlessly integrates HPC compute and data resources at the Oak Ridge Leadership Computing Facility and the National Energy Research Scientific Computing Center with ORNL's Compute and Data Environment for Science.
- **CINA: Computational Infrastructure for Nuclear Astrophysics** (2003-present / Software Architect / Lead Developer) - Multi-tier system to evaluate, manage, share, calculate, and visualize experimental nuclear data, thermonuclear reaction rates, and element synthesis simulations of explosive astrophysical phenomena such as X-ray bursts and core-collapse supernovae for the DOE Nuclear Data Program.
- **NMT: Nuclear Masses Toolkit** (2008-present / Software Architect / Lead Developer) - Multi-tier system to upload, modify, share, analyze, and visualize nuclear mass datasets for the DOE Nuclear Data Program.
- **Big Bang Online** (2006-present / Software Architect / Lead Developer) - System to evaluate, manage, share, calculate and visualize thermonuclear reaction rates, primordial abundance observations, "Big Bang" cosmological simulations, and cosmological constraints on these simulations.
- **GeoCODES: Geoscience Cyberinfrastructure for Open Discovery in the Earth Sciences** (2017-2019 / Project Lead / UI Developer) – An NSF-funded, cloud-based platform comprised of intuitive web-based tools, APIs, and eNotebooks enabling Earth science resource registration, search, discovery, and access through the application of open semantic web standards such as JSON-LD and Schema.org.
- **IsoDoX: DOE Isotope Program Document Exchange System** (2016-2017 / Software Architect / Sole Developer) - An online system for secure sharing, tracking, sorting, and searching of "Official Use Only" business-sensitive documents for the DOE National Isotope Development Center, US isotope production sites, and the ORNL Isotope Business Office, which processes all quotes, invoices, and contracts for research and commercial US Federal Government isotope product sales.
- **BEAM: Bellerophon Environment for Analysis of Materials** (2015-2017 / Software Architect / Lead Developer) - A computational workflow environment for near real-time big data analytics, modeling, and cloud-based data management for world class scientific experiments conducted at ORNL's Center for Nanophase Materials Sciences, Spallation Neutron Source, and Institute for Functional Imaging of Materials. BEAM seamlessly integrates HPC compute and data resources at the Oak Ridge Leadership Computing Facility with ORNL's Compute and Data Environment for Science.

- **Isotopes.gov and the NIDC Online Management Toolkit** (2011-2017 / Software Architect / Lead Developer / Webmaster / Cyber Security Officer) - Public ecommerce website and internal online order management software system for the DOE National Isotope Development Center, which is the sole federal government source of stable- and radio-isotope products with annual revenue approaching \$40M. These isotope products have wide utilization in basic science, cancer diagnosis and treatments, homeland security detectors, and other applications.
- **Conjunct** (2007-2009 / Lead Developer) - Multi-tier system to explore an integrated reliability test database for casing and tubing connections that addresses design engineering, purchasing, quality, operations, installation and management needs for the oil drilling industry for Hecate Software, Inc.
- **Advanced Probabilistic Tubular Design Toolkit** (2007-2009 / Lead Developer) - Multi-tier system to explore a large database of oil drilling pipe-casing properties and simulate pipe collapse and burst scenarios for Hecate Software, Inc.
- **Secretary** (2009 / Sole Developer): System to transmit simulation results from offshore oil drilling installations to data servers located on the mainland for Hecate Software, Inc.
- **Interactive Conceptual Model** (2007 / Sole Developer) - System that facilitates literature retrieval based on conceptual models by T N & Associates, Inc. for the EPA National Center for Environmental Assessment's Causal Analysis/Diagnosis Decision Information System.
- **RSim: A Regional Simulation to Explore Impacts of Resource Use and Constraints** (2005-2006 / Lead Developer) - An environmental decision support system designed specifically for military installations for the DOE Strategic Environmental Research and Development Program. The system explores the impacts and constraints of resource use by projecting future land cover changes and their impacts on environmental conditions by allowing users to calculate and visualize these projections.
- **Interactive Worked Examples** (2003 / Project Manager / Lead Developer) - Set of 93 highly interactive general physics modules for LightCone Interactive, LLC. This media was included with the following publications: *Physics for Scientists and Engineers* (6<sup>th</sup> ed. and later), *Principle of Physics* (3<sup>rd</sup> ed. and later), and *College Physics* (6<sup>th</sup> ed. and later) by Brooks-Cole/Thomson Publishing.
- **Virtual Astronomy Laboratories** (2003 / Developer) - Set of 20 highly interactive virtual astronomy laboratory modules for LightCone Interactive, LLC. This media was included with the following publications: *An Online Journey Through Astronomy* (2<sup>nd</sup> ed. and later), *Foundations of Astronomy* (8<sup>th</sup> ed. and later), and *The Cosmos – Astronomy in the New Millennium* (2<sup>nd</sup> ed. and later) by Brooks-Cole/Thomson Publishing.
- **Developing Reusable Components in Flash MX** (2003 / Sole Developer) - An interactive educational module funded by a Project SET grant provided by the Educational Technology Collaborative at the University of TN, Knoxville.
- **REACLIB aLIVE! REACLIB Rate Library Interactive Viewer** (2002 / Lead Developer) - Master's Thesis system to facilitate the analysis of the REACLIB thermonuclear reaction rate library that is utilized in solar, Big Bang, nova, x-ray burst, and supernova computational simulations.
- **The multimedia version of *Biology: A Guide to the Natural World*, 2<sup>nd</sup> ed.** (2001 / Developer) - Fully interactive, web-based content for the general biology textbook by LightCone Interactive, LLC for Prentice-Hall Publishing.

### Awards

- **ORNL Significant Event Award:** "Given in recognition of significant contribution to the BEAM Project Designed and Developed to Integrate the Computational and Analytical Power of High Performance Computing with Advanced Instrumentation at the Center for Nanophase Materials Sciences and the Spallation Neutron Source to Perform Near Real-time Scalable Data Analysis and Computational Modeling", 2016.
- **ORNL Significant Event Award:** "Given in recognition of significant contribution to the Isotopes Business System Conversion and Isotopes.gov Enhancement", 2015.
- **ORNL Computer Science and Mathematics Division Most Distinguished Award for a Special Contribution:** "Given in recognition of the development of the Computational Infrastructure for

Nuclear Astrophysics Cloud-based Software as a Service System for Modeling Nuclear Reaction Processes", 2014.

- **ORNL Computer Science and Mathematics Division Most Significant Technical Contribution Award:** "Given in recognition of the development of Isotopes.gov and the National Isotope Development Center Online Management Toolkit", 2013.
- **ORNL Computing and Computational Sciences Directorate Distinguished Contributor Award:** "Given in recognition of the development of the Bellerophon software system", 2011.
- **Research Assistantship from the Tennessee Center of Excellence for Educational Technology**, 2001-2002.
- **Robert C. Lide Citation for Outstanding Laboratory Development**, May 2001.
- **UT-ORNL Science Alliance Fellow**, 1998-2001.
- **East Tennessee State University Outstanding Graduating Senior in Physics**, May 1998.

### Synergistic Activities

- Co-instructor for the Nucleosynthesis Calculations Hands-On Station for the 2014 DOE Exotic Beam Summer School, ORNL (2014).
- Founding member and Chief Technical Advisor for the Nuclear Data Cloud Computing Consortium at ndc3.net (2013).
- Provided input to the Software Quality Assurance for Research Software SBMS procedure at ORNL (2011).
- Co-instructor for the Nucleosynthesis Calculations Hands-On Station for the 2010 DOE Exotic Beam Summer School, ORNL (2010).

### Presentations

- "EarthCube GeoCODES: An Emerging Platform for Resource Registration, Discovery, and Access", EarthCube Informational Webinar, Boulder, May 30, 2019.
- "BEAM: An HPC Pipeline for Nanoscale Materials Analysis and Neutron Data Modeling", Math and Neutrons Seminar, Shull-Wollan Center, Oak Ridge, Jan. 24, 2017.
- "BEAM: An HPC Pipeline for Nanoscale Materials Analysis and Neutron Data Modeling", The International Conference for High Performance Computing, Networking, Storage and Analysis (Supercomputing 2016), Salt Lake City, Nov. 15, 2016.
- "Band Excitation and Multivariate Analysis with the Bellerophon Environment for Analysis of Materials (BEAM)", Deep Data in Materials Characterization CNMS Workshop, Oak Ridge, Aug. 9-10, 2016.
- "BEAM: A computational workflow system for managing and modeling material characterization data in HPC environments", International Conference on Computational Science 2016, San Diego, Jun. 7, 2016.
- "BEAM: An HPC Analysis Pipeline for Nanophase Materials Science", Oak Ridge Leadership Computing Facility User Meeting, Oak Ridge, May 23, 2016.
- "BEAM: A Cloud-based High Performance Compute and Data Infrastructure for Near Real-time Analysis of Nanophase Materials Imaging Data", ORNL Center for Nanophase Materials Sciences Triennial Review, Oak Ridge, Apr. 27, 2016.
- "BEAM: A Computational Workflow System Enabling Scalable *In Silico* & Empirical Exploration of Materials Science Data in the DOE HPC Cloud", ORNL Neutron Data Analysis and Visualization Division (NDAV) / Center for Accelerating Materials Modeling (CAMM) Seminar, Oak Ridge, Jan. 13, 2016.
- "Bellerophon: A Computational Workflow Environment for Real-time Analysis, Artifact Management, and Regression Testing of Core-Collapse Supernova Simulations", The International Conference for High Performance Computing, Networking, Storage and Analysis (Supercomputing 2015), Austin, Nov. 17, 2015.

- "Near Real-time Scalable Analysis of High-dimensional Nanophase Materials Imaging and Neutron Science Data in the DOE HPC Cloud with BEAM", The International Conference for High Performance Computing, Networking, Storage and Analysis (Supercomputing 2015), Austin, Nov. 17, 2015.
- "Unifying *In Silico* and Empirical Experiments in CADES: Scalable Analysis of High-Dimensional Nanophase Materials Imaging Data with BEAM", ORNL CSMD Computational and Applied Mathematics Group (CAM) Seminar, Oak Ridge, Sept. 10, 2015.
- "Unifying *In Silico* and Empirical Experiments in CADES: Scalable Analysis of High-Dimensional Nanophase Materials Imaging Data with BEAM", Smoky Mountains Computational Sciences and Engineering Conference: Integration of Computing and Data Into Instruments of Science and Engineering, Gatlinburg, Sept. 2, 2015.
- "Bellerophon: A Computational Infrastructure for HPC Workflows and Experimental Data Analysis", ORNL Computational Data Analytics Group (CDA) Seminar, Oak Ridge, June 22, 2015.
- "A New Computational Infrastructure for the Advanced Analysis of Materials Imaging", Joint Nanoscale Science Research Center Workshop 2015: Big, Deep, and Smart Data Analytics in Materials Imaging, Oak Ridge, June 9, 2015.
- "Applying N-tier Architecture Design to HPC Workflows", Sandia National Laboratory / ORNL Workshop on Workflows, Oak Ridge, May 13, 2015.
- "Accelerating Scientific Discovery with the Bellerophon Software System", ORNL CSMD Seminar Series Presentation, Oak Ridge, Nov. 13, 2014.
- "Real-time Data Analysis and Visualization of HPC Core-Collapse Supernova Simulations with Bellerophon", International Conference on Computational Science 2014, Cairns, Australia.
- "Simulating Element Creation in Supernovae with the Computational Infrastructure for Nuclear Astrophysics (CINA) at nucastrodata.org", International Conference on Computational Science 2014, Cairns, Australia.
- "Bellerophon: A Software Support System for HPC Core-Collapse Supernova Simulations", 2014 ORNL Software Expo, Oak Ridge.
- "A Multi-Tier System for the Verification, Visualization and Management of CHIMERA", ORNL CSMD Seminar Series Presentation, Oak Ridge, Oct. 27, 2011.
- "Developing Multi-tier Software Applications for Astrophysics, Cosmology, and Nuclear Physics at ORNL", ETSU Physics & Astronomy Department Seminar, Johnson City, April 25, 2011.

## Publications

- V. E. Lynch, J. B. Calvo, E. Deelman, R. F. da Silva, M. Goswami, Y. Hui, [E. J. Lingerfelt](#), and J. S. Vetter, "Distributed workflows for modeling experimental data," 2017 IEEE High Performance Extreme Computing Conference (HPEC), Waltham, MA, 2017, pp. 1-5.
- S. Kalinin, E. Strelcov, A. Belianinov, S. Somnath, R. Vasudevan, [E. J. Lingerfelt](#), R. K. Archibald, C. Chen, R. Proksch, N. Laanait, and S. Jesse, "Big, Deep, and Smart Data in Scanning Probe Microscopy", *ACS Nano*, 2016, 10 (10), pp 9068–9086.
- [E. J. Lingerfelt](#), A. Belianinov, E. Endeve, O. Ovchinnikov, S. Somnath, J. M. Borreguero, N. Grodowitz, B. Park, R. K. Archibald, C. T. Symons, S. V. Kalinin, O. E. B. Messer, M. Shankar, and S. Jesse, "BEAM: A computational workflow system for managing and modeling material characterization data in HPC environments", *International Conference on Computational Science 2016*, *Procedia Computer Science*, Vol. 80, Pages 2276-2280, 2016.
- S. W. Bruenn, E. J. Lentz, W. R. Hix, A. Mezzacappa, J. A. Harris, O. E. B. Messer, J. M. Blondin, M. A. Chertkow, E. Endeve, [E. J. Lingerfelt](#), P. Marronetti, K. Yakunin. "The Development of Explosions in Axisymmetric Ab Initio Core-Collapse Supernova Simulations of 12–25 MSolar Stars", *Astrophysical Journal*, Volume 818, Number 2, 2016.
- [E. J. Lingerfelt](#) & O. E. B. Messer, "Bellerophon: A Computational Workflow Environment for Real-time Analysis, Artifact Management, and Regression Testing of Core-Collapse Supernova Simulations", *Proceedings of the International Conference for High Performance Computing, Networking, Storage and Analysis (Supercomputing 2015)*, 2015.

- K. N. Yakunin, A. Mezzacappa, P. Marronetti, S. Yoshida, S. W. Bruenn, W. R. Hix, E. J. Lentz, O. E. B. Messer, J. A. Harris, E. Endeve, J. M. Blondin, E. J. Lingerfelt. "Gravitational wave signatures of ab initio two-dimensional core collapse supernova explosion models for 12–25 MSolar stars", *Phys. Rev. D*, Vol. 92, 2015.
- E. J. Lingerfelt, O. E. B. Messer, S. S. Desai, C. A. Holt, E. J. Lentz. "Near Real-time Data Analysis of Core-Collapse Supernova Simulations with Bellerophon", *International Conference on Computational Science 2014, Procedia Computer Science*, Vol. 29, Pages 1504-1514, 2014.
- A. Mezzacappa, S. W. Bruenn, E. J. Lentz, W. R. Hix, O. E. B. Messer, J. A. Harris, E. J. Lingerfelt, E. Endeve, K. N. Yakunin, J. M. Blondin, P. Marronetti. "Two- and Three-Dimensional Multi-Physics Simulations of Core Collapse Supernovae: A Brief Status Report and Summary of Results from the "Oak Ridge" Group", *Numerical Modeling of Space Plasma Flows: ASTRONUM-2013, ASP Conference Series*, Vol. 488, Pages 102-113, 2014.
- E. J. Lingerfelt, M. S. Smith. "Isotopes.gov and the NIDC Online Management Toolkit", ORNL Technical Report, 2013.
- S.W. Bruenn, A. Mezzacappa, W.R. Hix, E.J. Lentz, O.E.B. Messer, E.J. Lingerfelt, J.N. Blondin, E. Endeve, P. Marronetti, K. N. Yakunin. "Axisymmetric Ab Initio Core-Collapse Supernova Simulations of 12-25 M<sub>⊙</sub> Stars", *ApJ* 767, no. 1, L6, Apr. 10 2013.
- S.W. Bruenn, E.J. Lentz, E.J. Lingerfelt, A. Mezzacappa, W.R. Hix, J.N. Blondin, O.E.B. Messer, P. Marronetti. "Neutrinos and Supernovae", *Hamburg Neutrinos from Supernova Explosions (HAVSE 2011)*, DESY, Hamburg, Germany, July 2011, in press.
- E.J. Lingerfelt, O.E.B. Messer, J.A. Osborne, R.D. Budiardja, A. Mezzacappa. "A Multitier System for the Verification, Visualization and Management of CHIMERA", *Procedia Computer Science*, Vol 4, Proceedings of the ICCS 2011, Pages 2076-2085, 2011.
- M. S. Smith, T. Sunayama, W. R. Hix, E. J. Lingerfelt, C. D. Nesaraja. "Bottlenecks and Waiting Points in Nucleosynthesis in X-ray bursts and Novae", *Proc. 10th Int. Symp. on Origin of Matter and Evolution of Galaxies*, Mar. 8 - 10, 2010, AIP Conf. Proc. 1269, pp. 439-441, 2010.
- M. S. Smith, E. J. Lingerfelt, C. D. Nesaraja, H. Koura, F. Kondev. "Nuclear Mass Visualization and Analysis at nuclearmasses.org", *The 10th International Symposium on Origin of Matter and Evolution of Galaxies*, Osaka (Japan), Mar. 8-10, 2010, AIP Conf. Proc. 1269, pp. 442-444, 2010.
- M. S. Smith, E. J. Lingerfelt, C. D. Nesaraja, W. R. Hix, L. F. Roberts, H. Koura, G. M. Fuller, D. Tytler. "Nuclear Data for Astrophysics: Resources, Challenges, Strategies, and Software Solutions", *International Conference on Nuclear Data for Science and Technology 2007*, ND 2007 349, 2008.
- M. S. Smith, R. Cyburt, H. Schatz, M. Wiescher, K. Smith, S. Warren, R. Ferguson, E. J. Lingerfelt, K. Buckner, C. D. Nesaraja. 2007. "Thermonuclear Reaction Rate Libraries and Software Tools for Nuclear Astrophysics Research", *Proc. 10th Int. Symp. on Origin of Matter and Evolution of Galaxies*, Dec. 4 - 7, 2007, AIP Conf. Proc. 1016, pp. 466-468, 2008.
- M. S. Smith, B. D. Bruner, R. L. Kozub, L. F. Roberts, D. Tytler, G. M. Fuller, E. J. Lingerfelt, W. R. Hix, C. D. Nesaraja. "Big Bang Nucleosynthesis: Impact of Nuclear Physics Uncertainties on Baryonic Matter Density Constraints", *Proc. 10th Int. Symp. on Origin of Matter and Evolution of Galaxies*, Dec. 4 - 7, 2007, AIP Conf. Proc. 1016 pp. 403-405, 2008.
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- B. H. Moazen, D. W. Bardayan, J. C. Blackmon, K. Y. Chae, K. Chipps, C. P. Domizioli, R. Fitzgerald, U. Greife, W. R. Hix, K. L. Jones, R. L. Kozub, E. J. Lingerfelt, R. J. Livesay, C. D. Nesaraja, S. D. Pain, L. F. Roberts, J. F. Shriner Jr., M. S. Smith, J. S. Thomas. "Measurement of the 183 keV Resonance in <sup>17</sup>O(p,α)<sup>14</sup>N Using a Novel Technique", *Phys. Rev. C* 75, 2007.

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- C.D. Nesaraja, E. J. Lingerfelt, J.P. Scott, M.S. Smith, W.R. Hix, D. W. Bardayan, J.C. Blackmon, Kyungyuk Chae, M.W. Guidry, R. A. Meyer. "A New Computational Infrastructure for Nuclear Astrophysics", *Proceeding, Eighth International Symposium on Nuclei in the Cosmos*, Vancouver, Canada, July 19-23, 2004, *Nucl. Phys. A* 758, p. 174-177 2005.
- E. J. Lingerfelt, J. P. Scott, C. D. Nesaraja, M. S. Smith, W. R. Hix, D. W. Bardayan, J. C. Blackmon, K. Chae, M. W. Guidry, J. E. Sharp, C. C. Hard, R. A. Meyer. "Visualization Tools for Nuclear Astrophysics Research", *71st Annual Meeting of the Southeastern Section of the American Physical Society (SESAPS)*, Oak Ridge, Tenn., Nov. 11-13, 2004, *Bull. Am. Phys. Soc.*, Vol 49, No 7 (2004) 47.
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- M. S. Smith, D. W. Bardayan, J. C. Blackmon, R. A. Meyer, K. Chae, M. W. Guidry, W. R. Hix, E. J. Lingerfelt, Z. Ma, J. P. Scott, R. L. Kozub. "Recent Nuclear Astrophysics Data Activities at ORNL", *Proceedings of the Origins of Matter and Evolution of Galaxies 2003 (OMEG03)*, Tokyo, Japan, Nov. 17-19, 2003, *World Scientific*, 2004.
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