

National Aeronautics and Space Administration



NASA's Cloud Services Infrastructure as a Service (IaaS), powered by Nebula™

Office of the Chief Information Officer

*NASA IT Vision: The NASA IT Organization is the **very best** in government*



Myra Bambacus
Program Manager



Agenda



- Cloud Computing Defined
- NASA Cloud Services
 - ✧ ARC/GSFC Plan
 - ✧ Joint Organization
 - ✧ Schedule
 - ✧ Network Architecture
 - ✧ Site Plan
 - ✧ Computing Capability
 - ✧ Energy Efficiencies
 - ✧ Visuals
- Discussions



Cloud Computing



Five essential **characteristics**:

- ***On-demand self-service.*** Provision computing capabilities as needed automatically.
- ***Broad network access.*** Available over the network and accessed through standard mechanisms.
- ***Resource pooling.*** Computing resources are pooled with location independence.
- ***Rapid elasticity.*** Capabilities can be rapidly and elastically provisioned.
- ***Measured Service.*** automatically control and optimize resource

NIST 2010



Cloud Computing



Three **service models**

- *Cloud Software as a Service (SaaS)*
- *Cloud Platform as a Service (PaaS)*
- *Cloud Infrastructure as a Service (IaaS)*

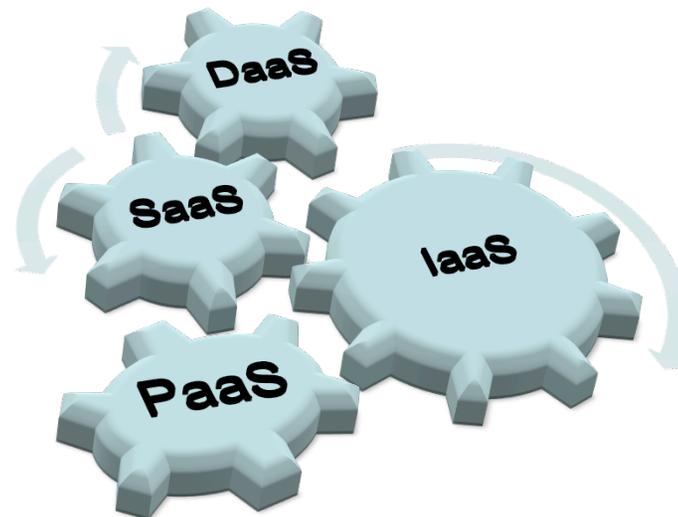
NIST 2010

- ***Data as a Service (DaaS)***
 - *Current Budget Language has a new emphasis on Cloud Computing. NASA Cloud Services, IaaS, powered by Nebula will satisfy these requirements.*

Agency cross-cutting capability

NASA Cloud Services, powered by Nebula™ program will provide highly-scalable, high-performance, on-demand cloud-based services to include:

- » Infrastructure (IaaS)
- » Platform (PaaS)
- » Application (SaaS)
- » Data (DaaS)





NASA Infrastructure as a Service (IaaS),



powered by Nebula™

- NASA CIO funded the collaborating team: Ames and GSFC to pilot innovations to better serve NASA scientists and Engineers.
- Partnership includes two instances at Ames and Goddard respectively, but working as one infrastructure.
- The infrastructure software stack is under development by Ames known as NASA Nebula.
- Goddard instance container/hardware procured through SEWP.
- IaaS allows NASA science and engineering to stand up computing storage and virtualization instances on demand



Establishing the Team



- Stakeholders (IT Leaders, CIOs, Senior Agency Staff and Operations)
- Cloud & Enterprise Architects
- Network Leads
- Data CentersOperations /Development
- Customer Services
- Users (Scientists, Systems Admin. Engineers)
- Procurement & Resources
- Security (IT & Physical)
- Facilities (planners and managers)
- Industry
- Communications & Outreach



NASA Cloud Services



Co-Executive Sponsor
James Williams, ARC CIO (Acting)

Co-Executive Sponsor
Adrian Gardner, GSFC CIO

External/Internal Partnerships
Rose Mucci
Danielle Moore*

Program Management
Co-Program Manager, Ray O'Brien*
Co-Program Manager, Myra Bambacus*

Project Management Support
Hadas Niv*
Myron Bradshaw*

Product Management
Soo Choi

Nebula (IaaS middleware)
Chief Architect
Jesse Andrews

Business Office (Budget, Procurement, Legal, etc.)

DaaS (Portal, Spatial Computing) Middleware
Project Manager
Myron Bradshaw *

Agency wide Configuration Control
TBD

Center-Specific Implementation and Operation Teams

Communications Danielle Moore*, Lead Frank Pietrucha*
Customer Training & Operations Jon Welch*, Lead John Antoun* William Eshaugh* Mark McInerney*
Website Developers Chris Antoun* Matt Antoun* Richard Schelleder*

IT Security Matt Linton, Technical* Matt Chew-Spence, Policy* Kanitra Tyler*	Software Dev PM and Procurement Brian Reed
Network Engineering Dave Hartzell* Mark Foster* Bobby Cates*	Systems Engineer Vish Ishaya
Subject Matter Experts Josh McKenty* Manesh Singh* Andy Smith*	Systems Engineer Todd Willey
Dev Ops Dean Troyer	Systems Engineer Devin Carlen
Dev Ops Matt Joyce	Jr. Software Engineer Jake Dahn*
	Systems Engineer Anthony Young

Budget Dave Baden*, Doug Pearson*
Procurement Lashawn Davis*
Legal TBD
Cost Model Yutsuan Ku*, Val Lunz*
Planning Val Lunz*, Doug Pearson*
Space Act Nona Cheeks

Chief Architect Phil Yang*	Geospatial Technologist Dan Whorton*
Data.gov engineer xxx*	Software Engineer xxx
Enterprise Architect Tonjua Hines Watts*	Software Engineer xxx
Data User Expert Mark McInerney*	Software Engineer xxx

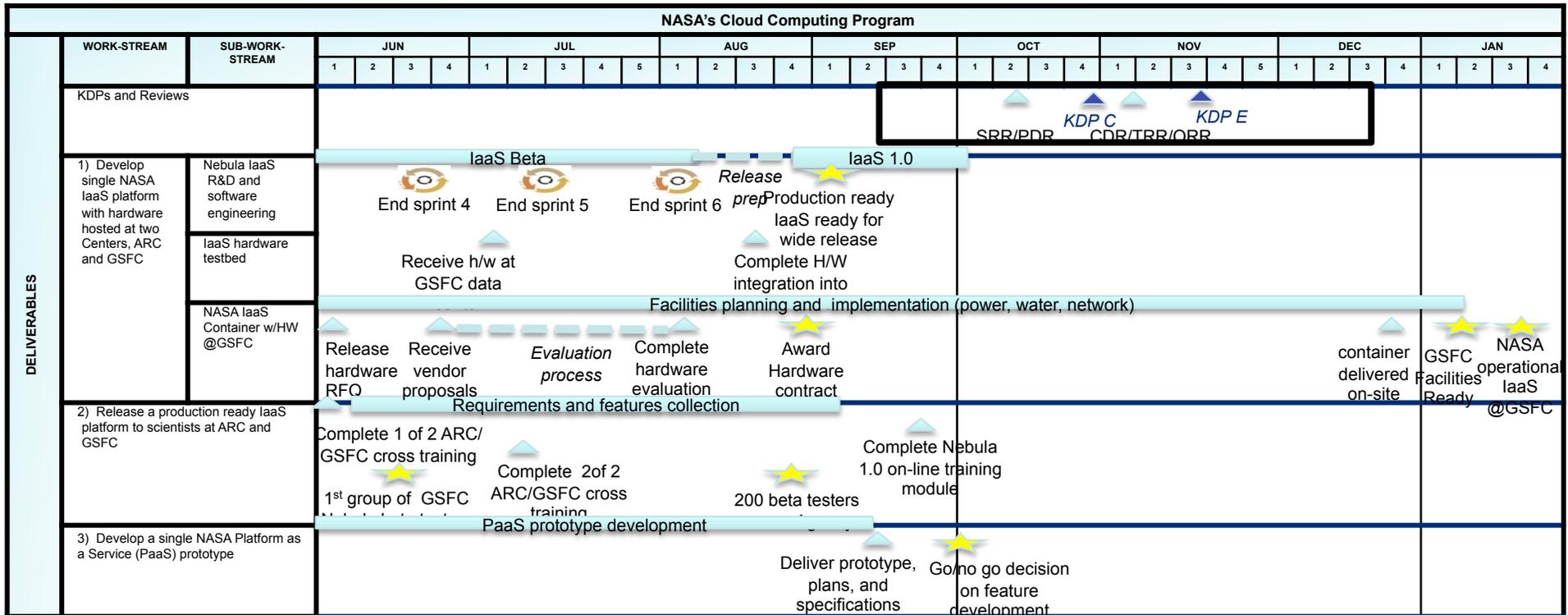
ARC TBD
GSFC TBD
JSC TBD
LaRC TBD

ARC	
PM: Y.K. Liu	
Customer Lead: John Antoun	
Ops Lead: Demetra Souliotis	
IT Sec: Matt Linton	
Tech Lead: Y.K. Liu	
Network Lead: Dave Hartzell	
GSFC	
PM: Myron Bradshaw *	
Customer Lead: Mark McInerney*	
Ops : Joe Stevens*, Dan Duffy*	
IT Sec: Mike Burr*	
Facility Lead: Todd Sanders*	
Network : Greg Goucher, Pat Gary*	
Tech Lead: Phil Yang*	
JSC	
PM: TBD	TBD
Customer Lead: TBD	TBD
Ops Lead: TBD	TBD
IT Sec: TBD	TBD
Tech Lead: TBD	TBD
Network Lead: TBD	TBD
LaRC	
PM: John Evans	
Customer Lead: TBD	TBD
Ops Lead: TBD	TBD
IT Sec: TBD	TBD
Tech Lead: TBD	TBD
Network Lead: TBD	TBD

KEY
Black Text = Civil Servant
BlueText = Contractor
* = Less than 100% allocated



Schedule Status



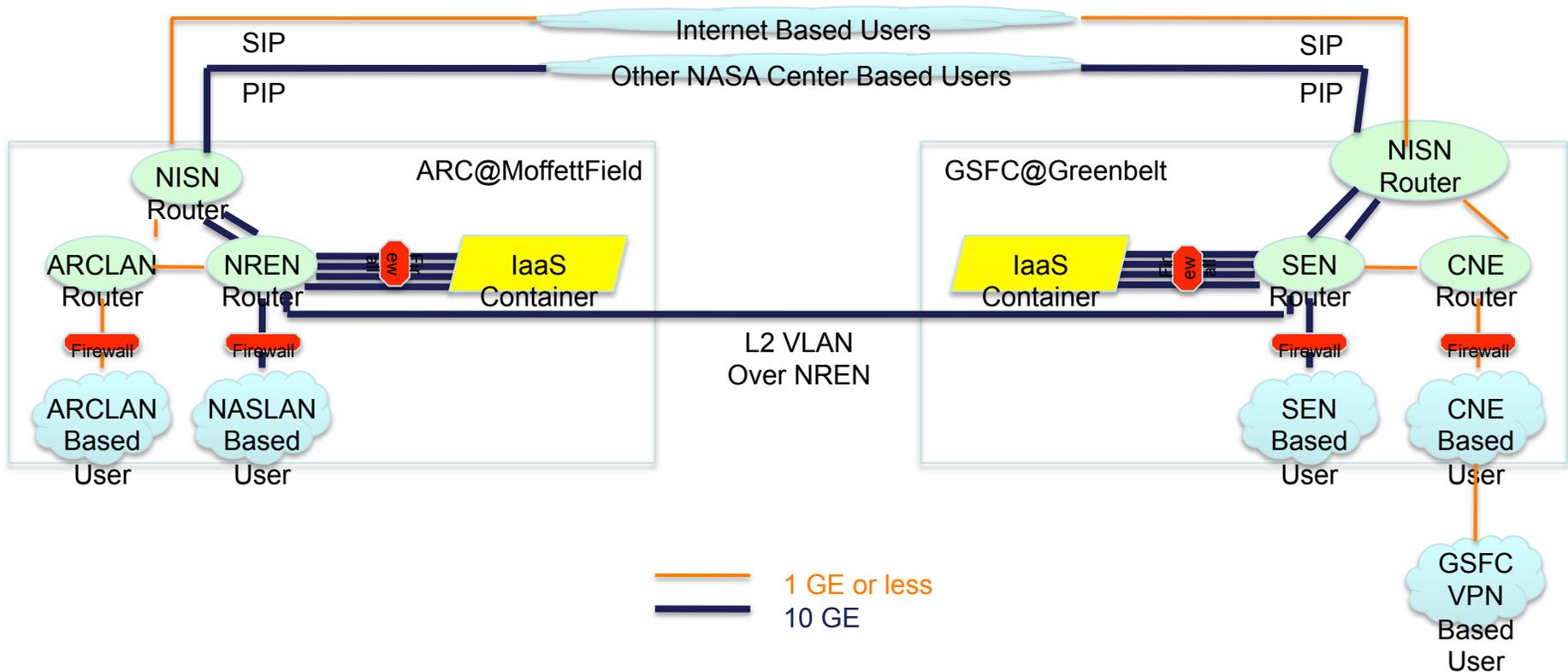
August 2010

IaaS Status Update





NASA IaaS Network Architecture



 **Near B.28** 





Computing Capability



- Delivery of computer infrastructure as a service.
- Instead of buying servers, software, data center space or network equipment.
- Evolution of Web hosting, and virtual server offerings
- Dynamic/On Demand Computing and Storage
- Offering on-site training and support
- Based on Open Source Software



IaaS: Racks / H/W Configuration



Nodes:

- 2 X Firewall (R710): Westmere 2.8 GHz X 2, 12 GB RAM, 4x1TB HDD,
- 8 X Other Utility Nodes (C1100): Westmere 2.8 GHz X 2, 48 GB RAM, 2x1TB HDD,
- 56 X Computing/Storage Nodes (C2100): Westmere 2.8 GHz X 2, 96 GB RAM, 12x2TB HDD,

Network

2X10GbE connection to SEN

Statistics:

CPUs: 132 CPUs, 796 CPU Cores

RAM: 5784 Gbytes or ~ 5.7 TB

HDD: 1346 Tbytes or ~1.3 PB

UPS: sustain 12 minutes





Energy Efficiencies



- Cloud Computing is 5 to 7 times more efficient than traditional data centers
- Nebula's container density provides 50% energy efficiency over traditional data centers
- Experimenting with technology that allows us to power off servers when not in use





Pilot Projects



- USASpending.gov 2.0
- Microsoft World Wide Telescope (Mars / Moon)
- Google Earth Planetary Content (Mars)
- LMMP Program Data Processing (Moon)
- TOPS Earth Climate Modeling





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