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Jetstream2: Accelerating cloud computing via Jetstream

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Jetstream & Jetstream2 Primary Investigator

PEARC21 – July 20, 2021

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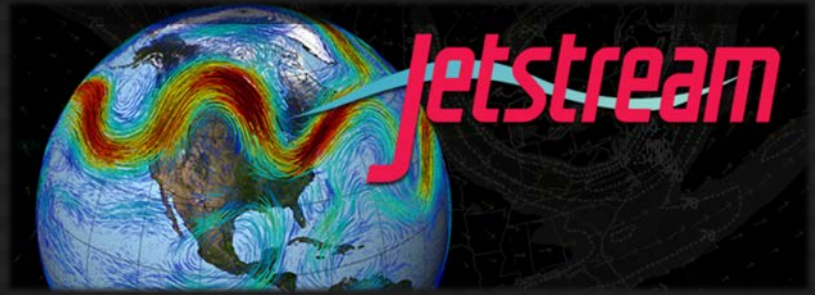
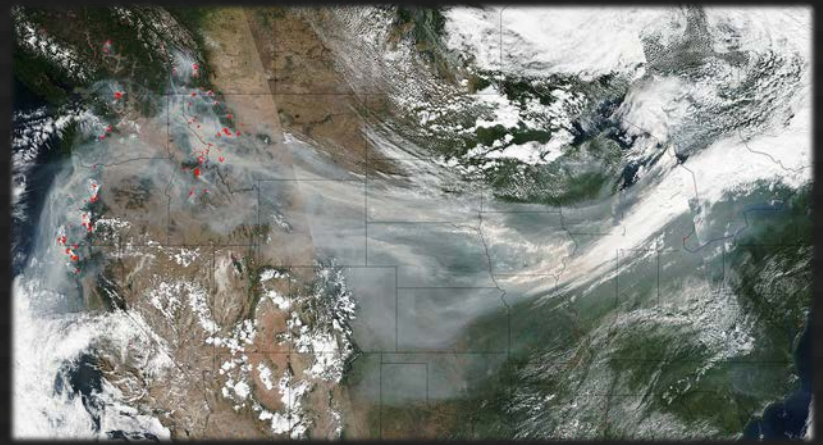
What is “the” Jetstream?

- Fast moving air currents
- Hot/Cold air boundaries
- An NSF-funded cloud environment





Suomi NPP satellite collected this naturaNASA'sl-color image using the VIIRS (Visible Infrared Imaging Radiometer Suite) instrument on Sept. 4, 2017. Actively burning areas are outlined in red. NASA image courtesy Jeff Schmaltz LANCE/EOSDIS MODIS Rapid Response Team, GSFC

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What is Jetstream2 and why does it exist?

- Significant evolution of the Jetstream cloud resource
- Under 10% NSF investment –> support for 24% of institutions, 23% of active PIs, and 32% of users*
- Jetstream has provided 6x more SUs than any other XSEDE resource for Education
- Emphasis on ease-of-use, broad accessibility, *AI for Everyone*
- Will provide on-demand *interactive* computing and persistent services for science gateways
- Enables *configurable* environments; *programmable cyberinfrastructure*

*Based on XDMoD data at Workload Analysis Report: http://arxiv.org/abs/1801.04306

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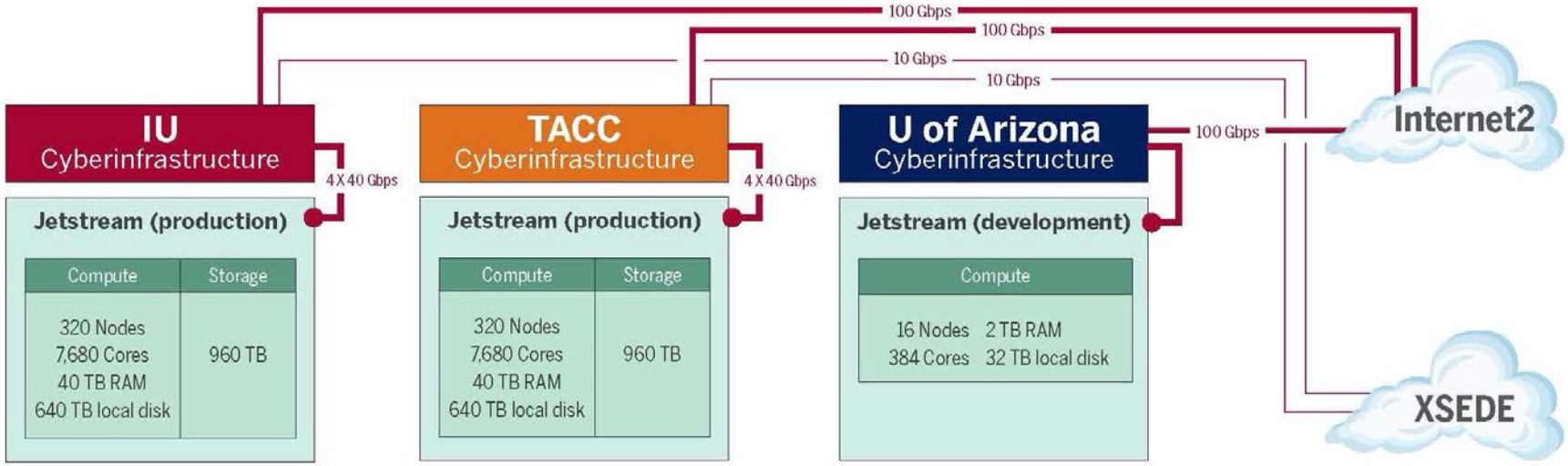
Jetstream [1] System Overview



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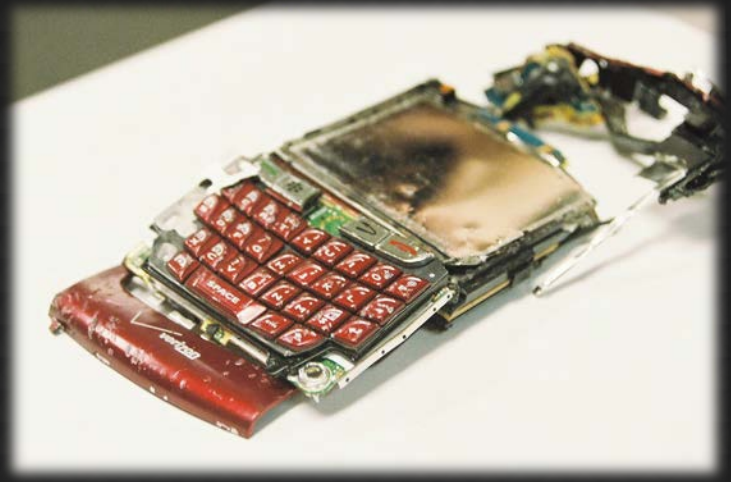
What worked?

- Allowing API access and full control (root privileges)
- “Indefinite workflows” – allowing instances to run continuously – providing PIs renew their allocations
- Development of trial allocations



Flickr user MattHurst – Broken Blackberry

What didn’t work?

- Forcing small allocations into the research allocation process
- Lack of multi-year allocations
- Lack of shared data set storage

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Lessons learned

Challenges -> Inspired changes

- Storage capacity -> Larger HDD pool and new flash storage
- Homogeneous hardware -> Inclusion of NVIDIA GPUs (w/MIG) and memory diversity
- Separate OpenStack domains -> Unification of “Atmosphere” domain

D.Y. Hancock – Castello di Nipozzano 2017

- Virtual networking architecture/maintenance -> Increase offload capabilities via Cumulus Networks software and Mellanox hardware (NAT & simulation)
- Acceptance & integration into national CI ecosystem -> Changes to our metrics/KPIs & accounting processes
- Deployment diversity -> Leverage single technology for config management

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Jetstream2 Capabilities

Enhancing IaaS model of Jetstream:

- Improved orchestration support
- Elastic virtual clusters
- Federated JupyterHubs
- Ease storage sharing (CephFS w/Manilla)

Commitment to >99% uptime

- Critical for science gateway hosting
- Hybrid-cloud support

Revamped User Interface

- Unified instance management
- Multi-instance launch

Feb 12, 2019 – Jet stream region called "Jet N6"
NASA/JPL-Caltech/SwRI/MSSS/Kevin M. Gill

- >57K cores of next-gen AMD EPYC processors
- >360 NVIDIA A100 GPUs will provide vGPUs via NVIDIA's MIG feature
- >17PB of storage (NVMe and disk hybrid)
- 100GbE Mellanox network

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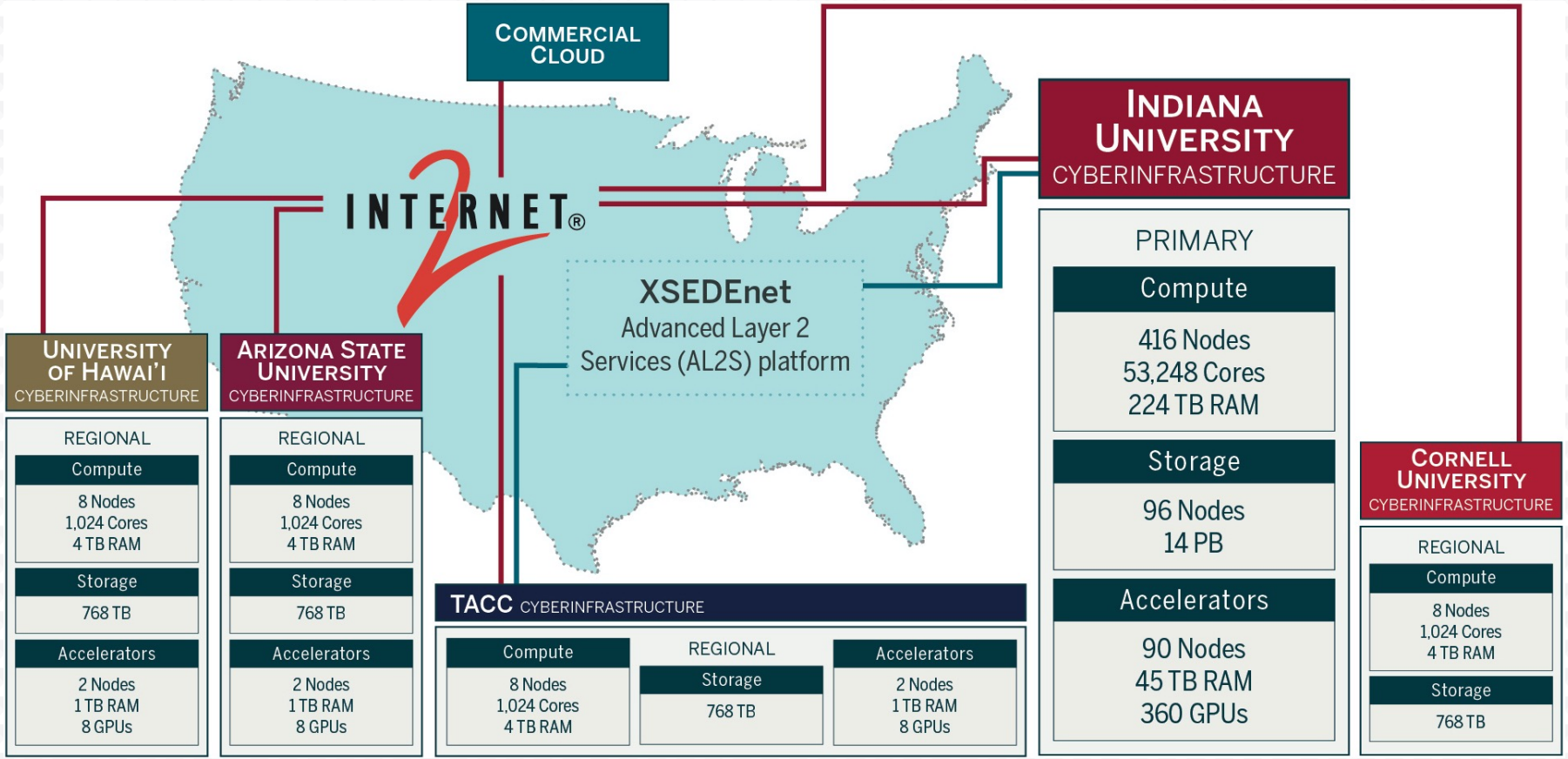
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XSEDEnet
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CYBERINFRASTRUCTURE
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53,248 Cores
224 TB RAM
Storage
96 Nodes
14 PB
Accelerators
90 Nodes
45 TB RAM
360 GPUs
UNIVERSITY OF HAWAI'I
CYBERINFRASTRUCTURE
REGIONAL
Compute
8 Nodes
1,024 Cores
4 TB RAM
Storage
768 TB
Accelerators
2 Nodes
1 TB RAM
8 GPUs
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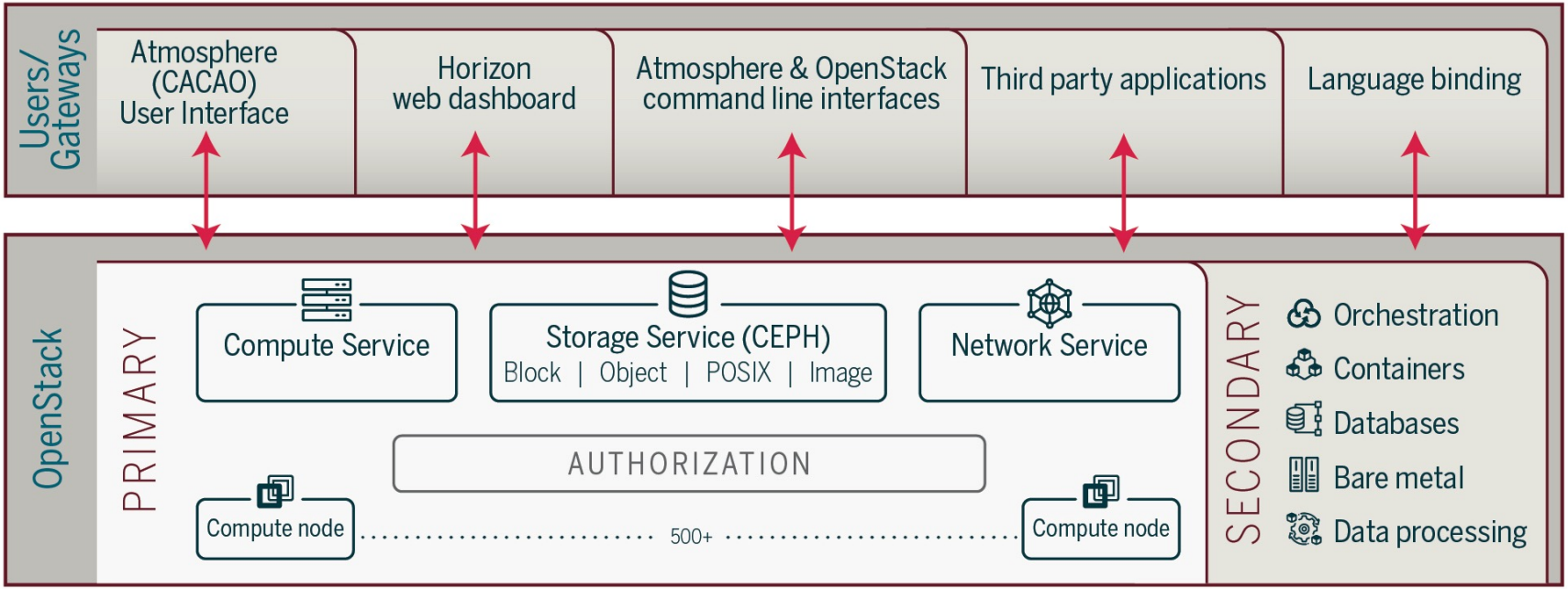
Conceptual Jetstream2 Architecture



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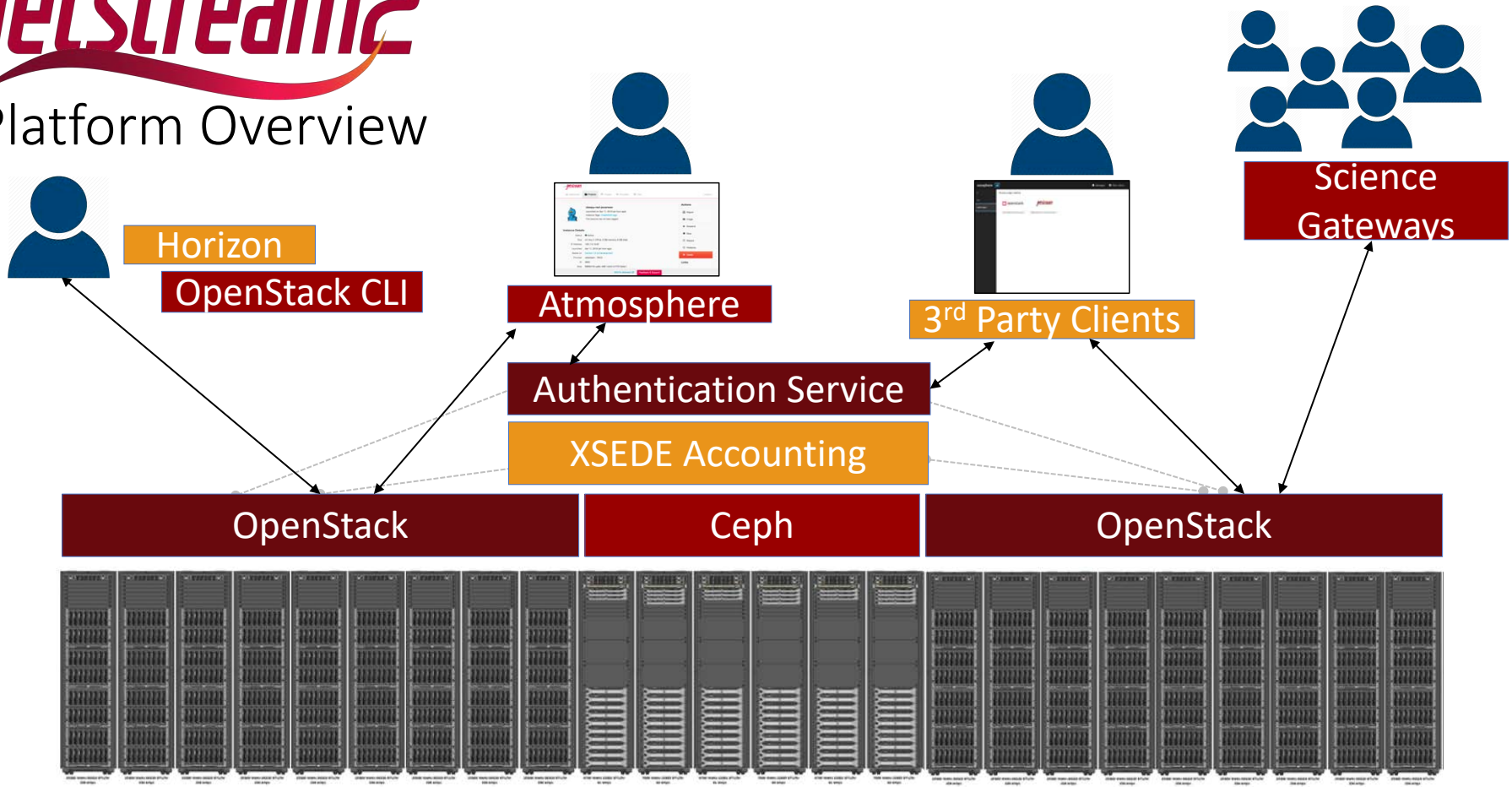
Platform Overview



Jetstream2 Core System

Timeline

- Jetstream now in 5th year of operations
- Jetstream extension granted by the NSF through November 2021
- Extension through March 2022 in process
- Jetstream2
  - Early operations planned for December 2021
  - Production operations by January 2022

Flickr user Oiluj Samall Zeid - Lejos de Yulín

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http://jetstream-cloud.org/
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