

Enabling Information Sharing thru Common Services

Using Systems Thinking to Provide Solutions to OGC Data Requirements

Presented To: ATIEC Conference

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NOAA

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Date: September, 2011

The banner features a stylized illustration of an airplane flying over a landscape with a lighthouse and a sun. The background is a gradient of blue and orange. In the top right corner, there are logos for EUROCONTROL and the Federal Aviation Administration. The text is centered and right-aligned in the lower half of the banner.

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**Air Transportation Information
Exchange Conference - (featuring
AIXM, WXXM and FIXM)**

August 30, 2011 - September 1, 2011
NOAA Science Center & Auditorium
Silver Spring, Maryland

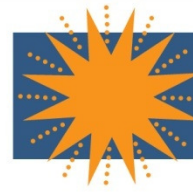
Introduction



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Overview of the Issues

- **What is Systems Thinking?**
- **Current State**
- **Desired State**
- **Developing Systems Thinking Approach**
- **Identifying Testing and Analysis Requirements**
- **Systems Thinking to Balance the Result**
- **Conclusions**



What is Systems Thinking?

- **Checkland – Use of non-conventional approaches based on solutions from dis-similar industry successes**
- **Boardman – Development of systemigrams to determine solutions**
- **Buede – Modeling system requirements through modeling software**
- **Farr – Linear system approaches through mathematics**
- **Zachman – Analysis through logical static models (generally referred to as spiral development)**

Systems Thinking



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The best method to achieve results using systems thinking involve the following steps:

- **Review all current work performed**
- **Identify the broadest use base possible**
- **Determine the current state**
- **Use Systems Thinking to identify the ‘End State’**
- **Gather all data along the value chain to drive to the End State**
- **Describe Vision**
- **Implement Solution(s)**

Review all Current Work Performed



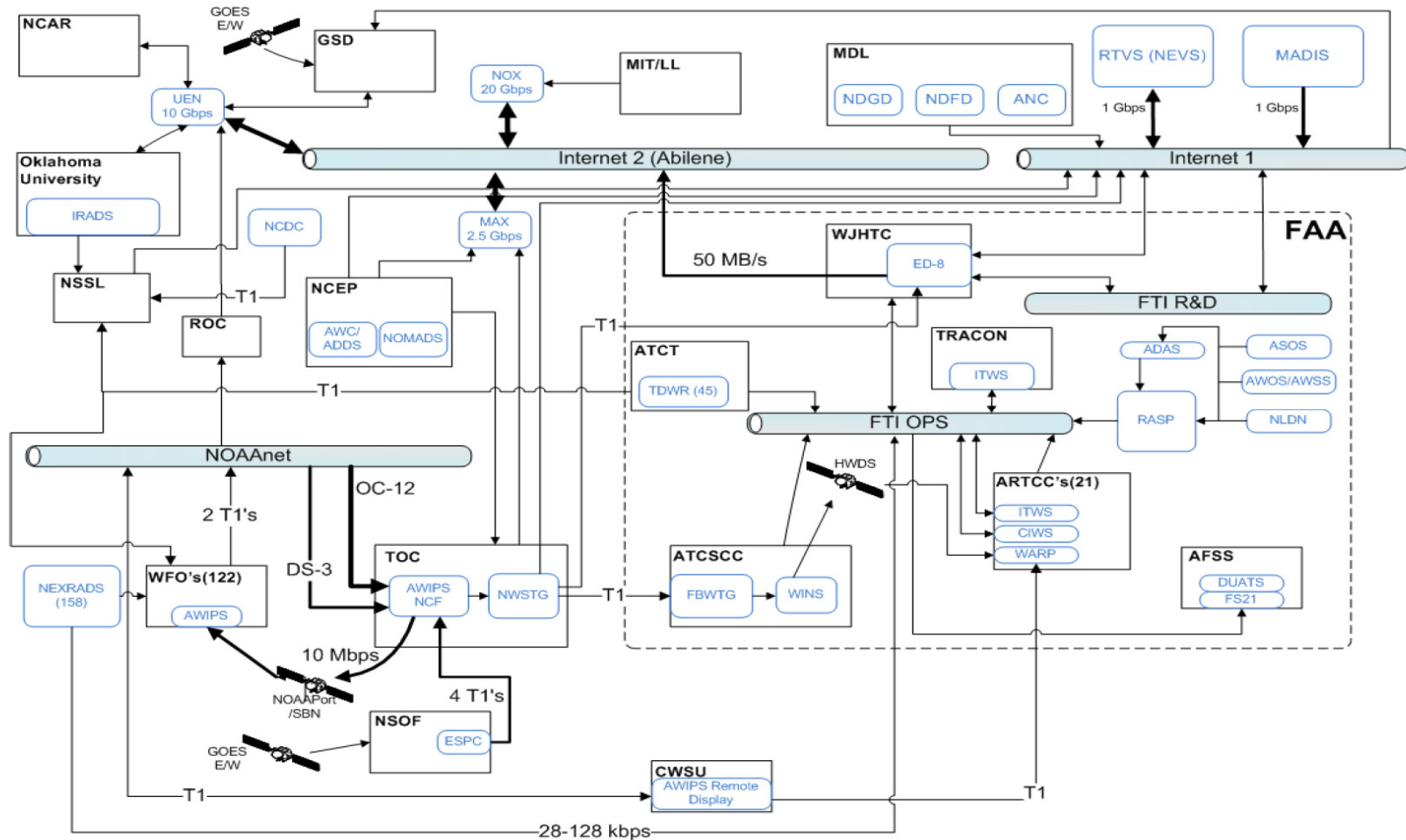
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- Identify all studies performed, requirements generated and broad user base;
- Consider that work performed prior was done within the boundary of current thinking;
- Re-use what is applicable so there is no duplication of effort

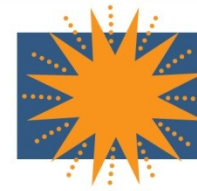


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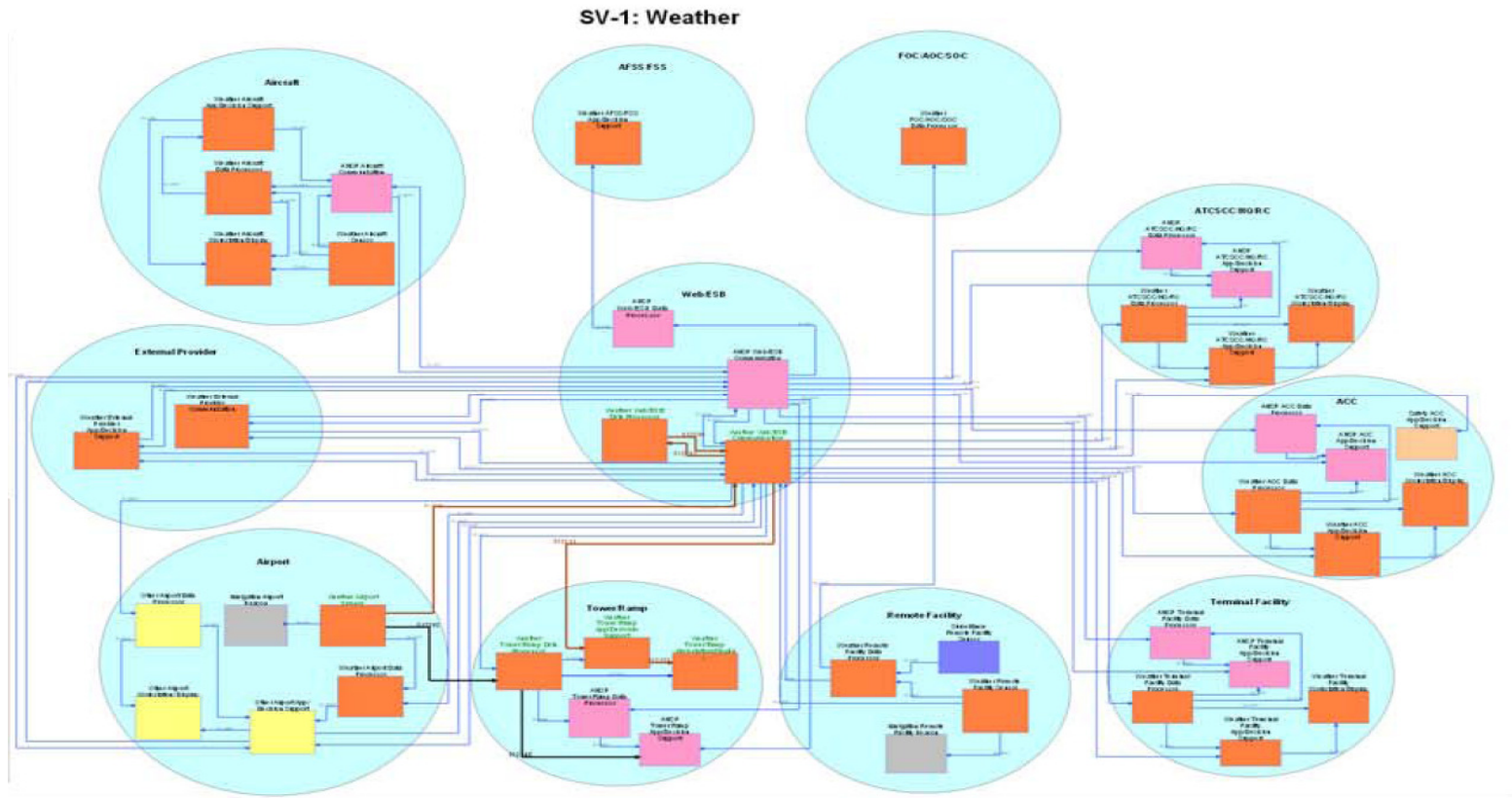
Current State



Systems Thinking: Building the Desired State



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SV-1 Weather Slide from JPDO ConOps. Weather servers more than the FAA

Systems Thinking: Building the Desired State



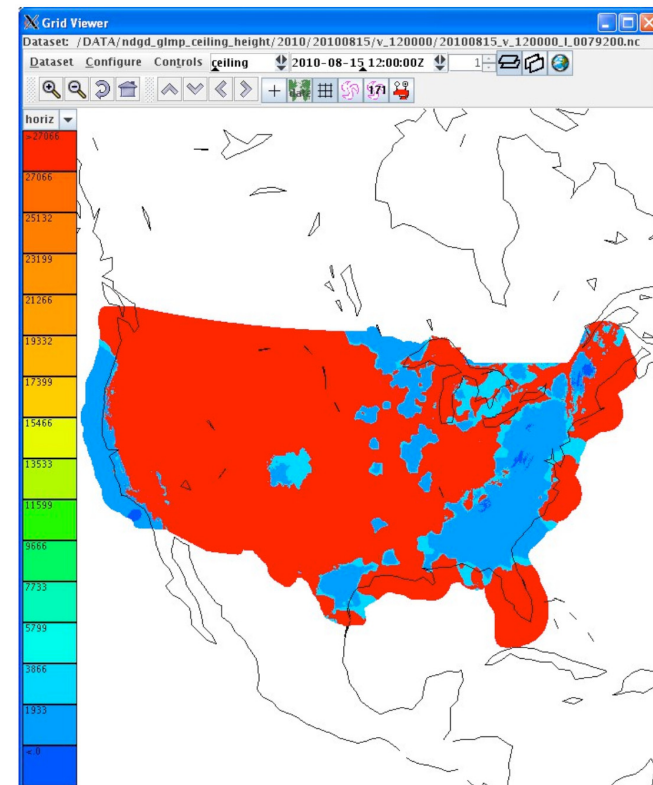
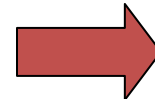
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It is desirable for the FAA to have data available in OGC format, available from a central location and use smart push-pull to get those data to and from source and FAA. This same concept is desirable for more users than the FAA, but they are a great test case and it meets the NextGen mission

Data located in diverse and multiple locations in different formats

Row	Name	Type	Description	Status	Version ID	Registry
11	Base Reflectivity 2km, Max Rfl	Dataset	Base Reflectivity mosaic at 2km resolution, with Maximum Reflectivity for the New York (ZNY) Air Route	Subm.	b04f627f6c18f989a	WHJTC Registry 1
12	Base Reflectivity 2km, Optimal	Dataset	Base Reflectivity mosaic at 2km resolution, with Optimal processing for the New York (ZNY) Air Route	Subm.	5d0874653e9d3519a	WHJTC Registry 1
13	Base Reflectivity 4km, Max Rfl	Dataset	Base Reflectivity mosaic at 4km resolution, with Maximum Reflectivity for the New York (ZNY) Air Route	Subm.	23228a615022ab01e	WHJTC Registry 1
14	Base Reflectivity 4km, Optimal	Dataset	Base Reflectivity mosaic at 4km resolution, with Optimal processing for the New York (ZNY) Air Route	Subm.	c06985b08f0c4680	WHJTC Registry 1
9	Composite Mosaic, 0-50k feet	Dataset	Composite Mosaic (0-50k feet) at 4km resolution, with Maximum Reflectivity processing	Subm.	53573a07d7573722	WHJTC Registry 1
1	Composite Mosaic, 0-50k feet	Dataset	Composite Mosaic (0-50k feet) at 4km resolution, with Optimal processing for the New York (ZNY) Air Route	Subm.	4c14886c3b3b7d9f42	WHJTC Registry 1
2	Digital VIL Mosaic, 2km	Dataset	(VIL) Vertical Integrated Liquid Mosaic at 2km resolution, for the New York (ZNY) Air Route	Subm.	9f5e9d62404b6f01d	WHJTC Registry 1
3	Digital VIL Mosaic, 4km	Dataset	(VIL) Vertical Integrated Liquid Mosaic at 4km resolution, for the New York (ZNY) Air Route	Subm.	33a5d3f0b075752c1	WHJTC Registry 1
4	EET Mosaic, 2km	Dataset	Enhanced Echo Tops Mosaic (EET) at 2km resolution, for the New York (ZNY) Air Route	Subm.	4f7455d2200505a97	WHJTC Registry 1
5	EET Mosaic, 4km	Dataset	Enhanced Echo Tops Mosaic (EET) at 4km resolution, for the New York (ZNY) Air Route	Subm.	1a89a2b765c0e0e1a2	WHJTC Registry 1
6	ET Mosaic, 4km	Dataset	Echo Tops Mosaic (ET) at 4km resolution, for the New York (ZNY) Air Route Traffic Cont.	Subm.	19e64cbb226e9c2a	WHJTC Registry 1
7	LCR Mosaic, 4km, Highest Alth	Dataset	Layer Composite Reflectivity (LCR) 24-50k feet/highest altitude, for the New York (ZNY) Air Route	Subm.	14950001245d8249a	WHJTC Registry 1
9	LCR Mosaic, 4km, Super High Al	Dataset	Layer Composite Reflectivity (LCR) 23-50k feet/super high altitude, for the New York (ZNY) Air Route	Subm.	5d17557123757571d	WHJTC Registry 1
9	Lightning Flash	Dataset	The LightningFlashType is an extension of wx-AbstractWxFeatureType to allow encodim.	Subm.	cd80599448792330	WHJTC Registry 1
10	LRL Mosaic, 4km	Dataset	Lower Layer Reflectivity (LRL) 0-24k feet/low altitude, for the New York (ZNY) Air Route	Subm.	27571a30e036082e4	WHJTC Registry 1
15	Surface Observation	Dataset	Structured representations of Surface Observation messages, such as METARs from RA.	Subm.	250e8a7d5461b035b	WHJTC Registry 1

Converts to Net-Ready OGC Format and sends to FAA like this

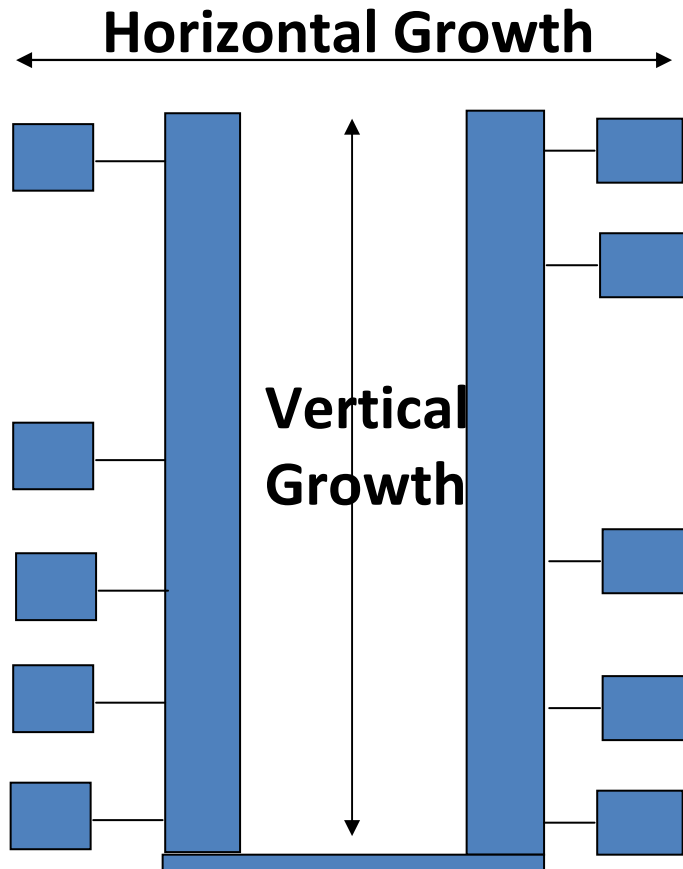


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Systems Thinking: Building the Desired State



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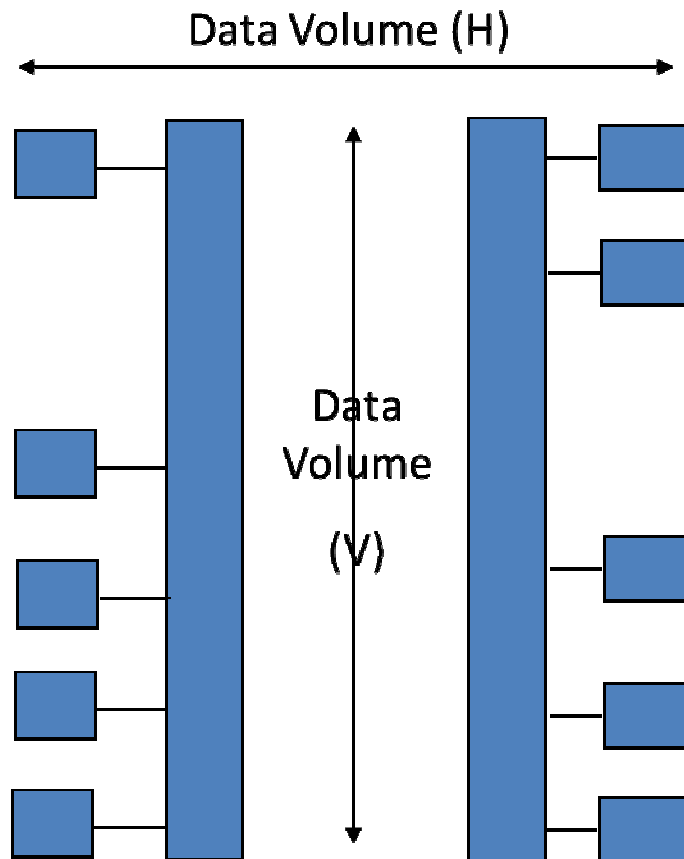
So how do agencies decide what vertical and horizontal growth consist of?

So how do agencies decide if they are able to connect with another agency?

Horizontal and Vertical growth are noted in the DoDAF, but not defined.



Systems Thinking: Building the Desired State

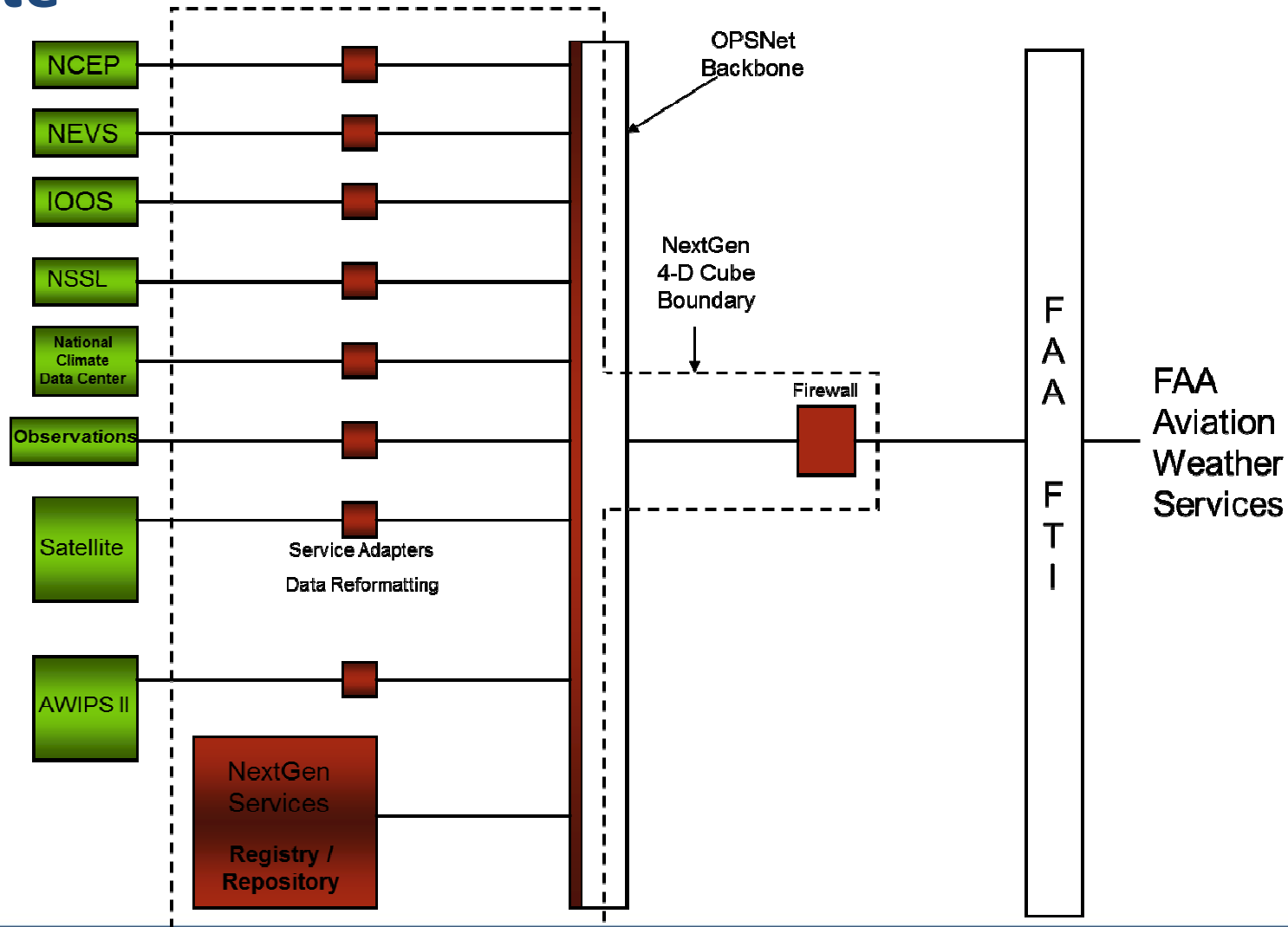
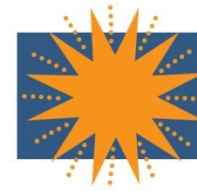


- A common elements for size is data volume
- Baseline data volume currently being handled
- Establish Relationship of

$$\frac{V_h}{V_v} = 1$$

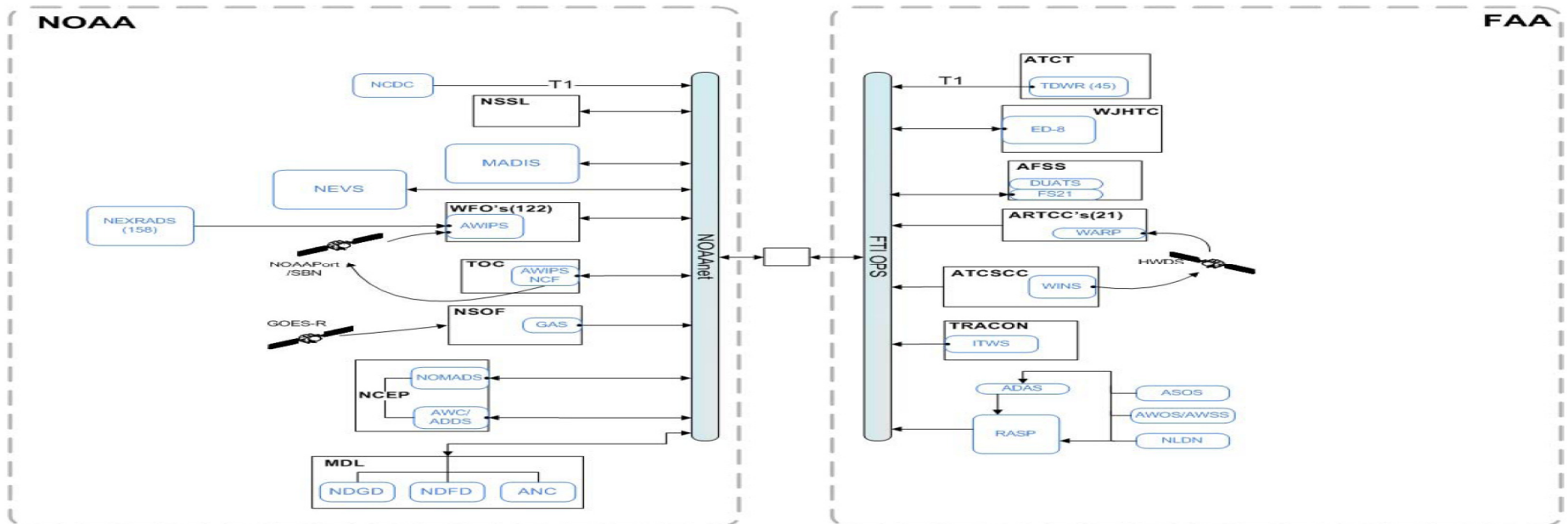
Once balance is established, it becomes apparent the additional hardware and comms needed to maintain balance

Systems Thinking: Desired State





Systems Thinking: Desired State

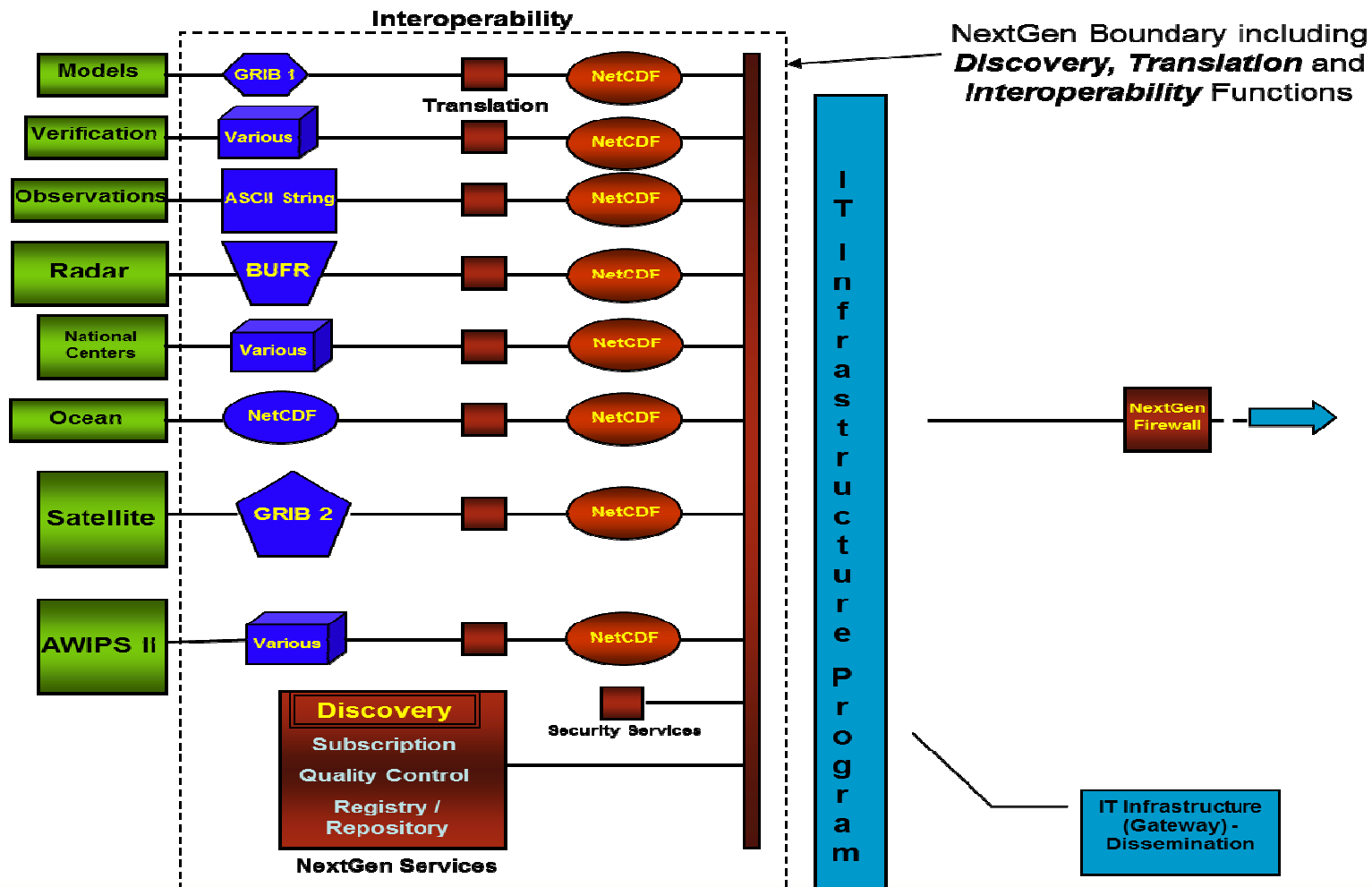


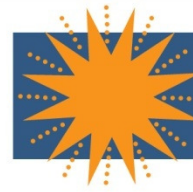
CEArch_v3.png

Following this model, the NOAA / FAA test bed was constructed to simulate this situation. Currently, the mass balance is almost 1 with saturation of the system at 125 users. Using systems thinking provided the basis for the testbed and eventually for the vision using NextGen 4-D Data Cube as a discovery, translation and dissemination capability



Systems Thinking: Desired State





Systems Thinking: Balancing the Results

- **Next, a data map with complete touch points now becomes imperative;**
- **Also, a full data dictionary containing all source data products, their formats, frequency of update, file size and current formats was developed;**
- **The Data Map and Data Dictionary become the baseline for the vision to keep the new solution at a ratio of 1**

Systems Thinking: Seeing the Future



- **Model data volumes**

- Model data disseminated today: **703GBytes/day**
- NCEP produces more data than it disseminates:
 - Some models too large in native resolution, are disseminated at lower resolution
 - Intermediate model results/outputs are not being disseminated

Model Data - Dissemination Method	Volume (Gbytes/day)	% of Available data
SBN Broadcast	22.3	3.16%
NWSTG	23.5	3.34%
NWSTG FTP	169	24%
WOC	703	100%

Table 4

- SBN broadcasts only a small percentage of available model data
- NWSTG takes in only a small percentage of available model data
- NWSTG FTP (non switched) takes in less than a quarter of available model data
- By 2015, it is anticipated that available model data will grow from **703GBytes/ day** to

7,448GBytes/day, representing an increase of **over 10x**.

- Note: the increase in data volume is attributed only to NCEP models, while international models are assumed to have constant data volume.

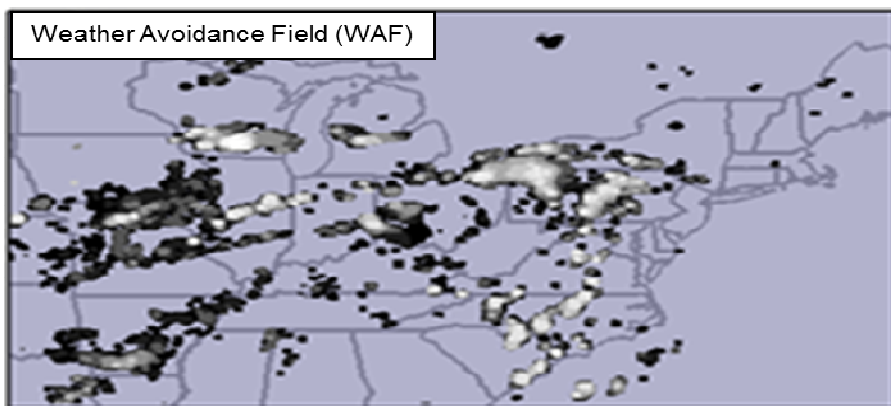
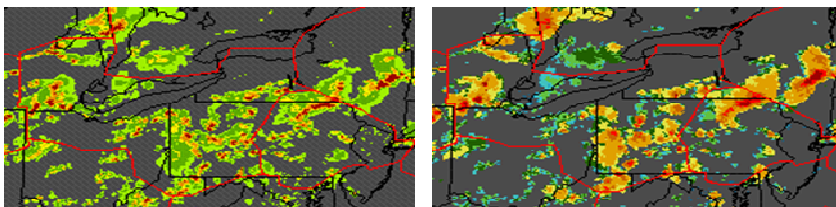
By 2015, model data capacity will be 10x greater than they are today

Systems Thinking: Seeing the Future

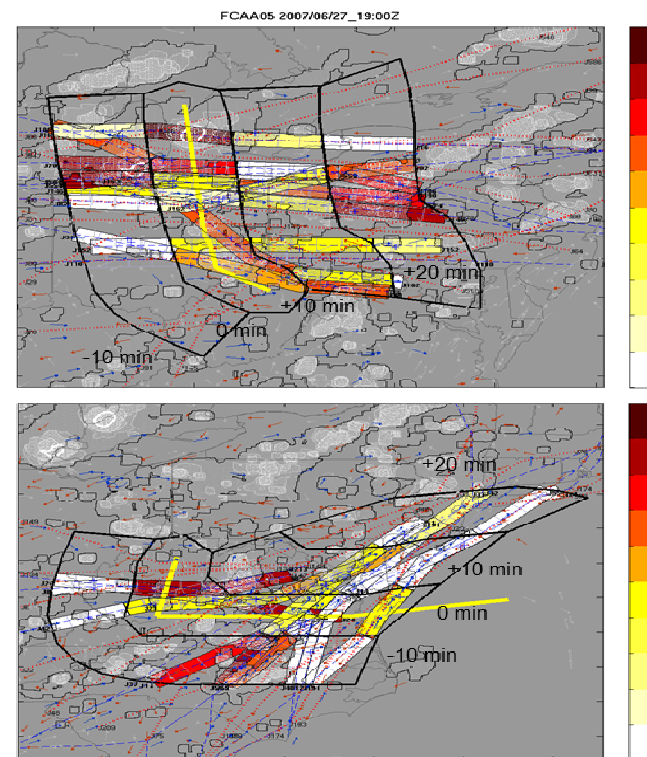


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Weather Cube Output



Translation



Impact

Weather



Estimated Airspace Availability

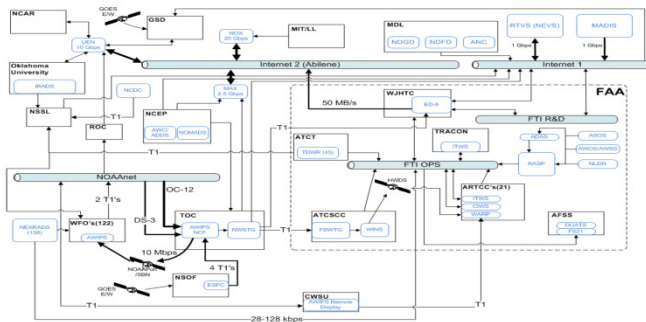


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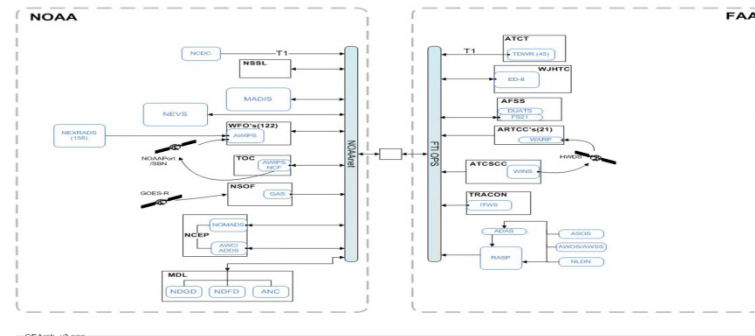


Systems Thinking

It takes a lot to get from this:

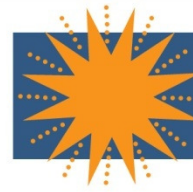


To this:



- Not readily expandable
- Expensive with needless complexity
- Multiple and incompatible data formats

- Improved Efficiency
- Consolidation of data lines
- Reduced operating costs
- OGC data format



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Thank You

Questions please email
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