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Just in Time Capacity Planning

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SHARE in San Francisco 2013

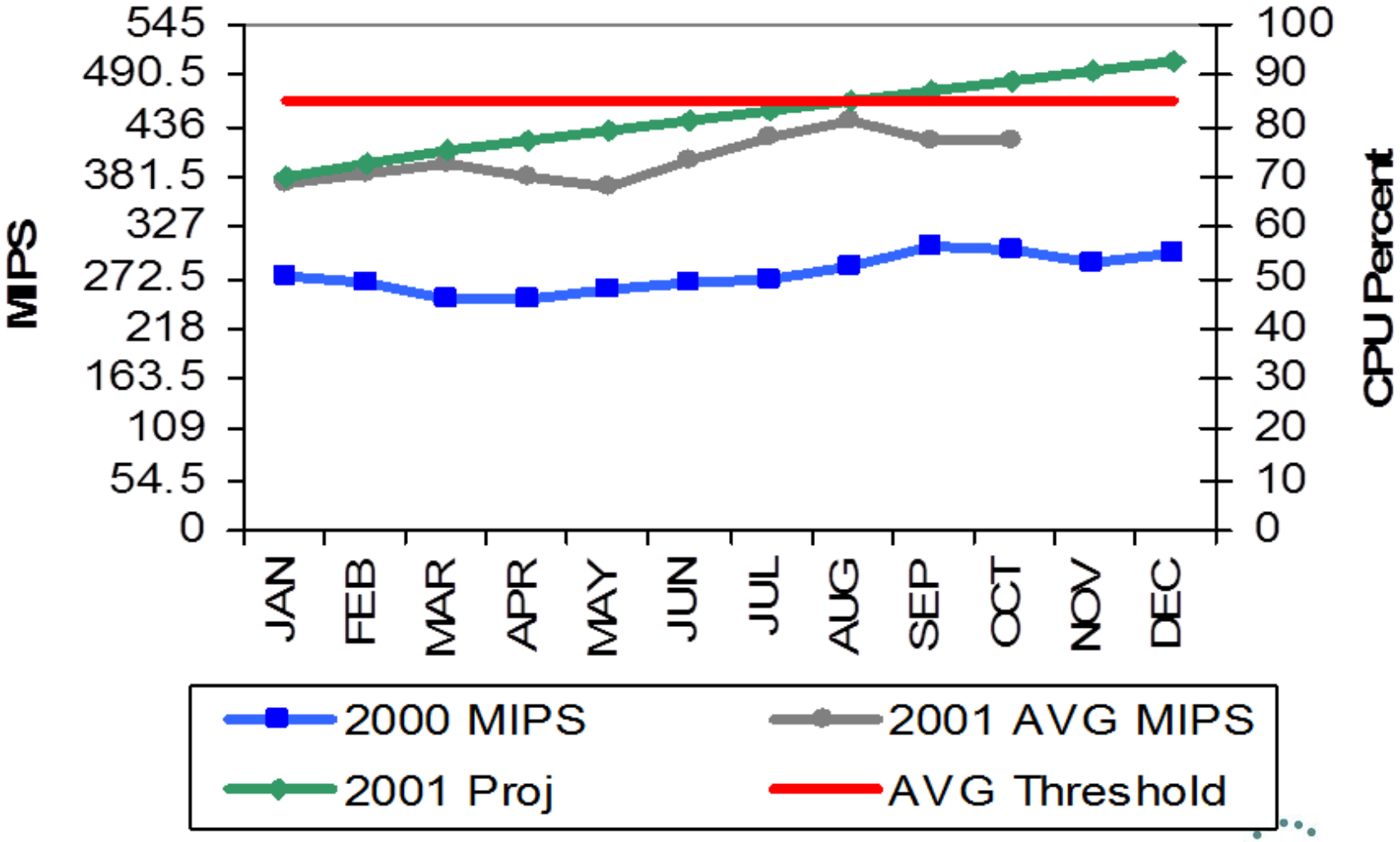
Just in Time Capacity Planning

- The Beginning
  - Brief Background
    - Capacity Planner - 20+ years
    - Worked in a variety of industries
      - *Insurance*
      - *Airline*
      - *Consumer Credit*
      - *Hospital / Educational*
      - *Outsourcing*
      - *Retail*

Just in Time Capacity Planning

- The Beginning of Capacity Planning
  - Art vs Science
  - Crystal Ball
  - Methodology
    - Monthly Charts
    - Straight Trend Lines
    - Forecast
      - *Look at the past*
      - *Collect information from applications (if possible)*
    - Linear Regression

Just in Time Capacity Planning
Traditional View of Capacity Data



Just in Time Capacity Planning

- Weekly View versus Monthly View
  - The Monthly view of the data obscures variations in the seasonal cycle.
  - The Weekly view allows the capacity planner to see smaller trends and variations that occur at the approximate same time each year.
  - Drill down further?
    - Ability to go to a lower level such as daily view of the world

Just in Time Capacity Forecasting

- The Challenge
  - Is there a way to show the seasonal variations in a capacity forecast?
  - Were there measurable variations on a weekly basis that could be captured?
  - If so, could this be used to create a capacity forecast?
  - Can it be used across various types of businesses?
  - Even with changes in the environment, do the same peaks/valleys occur on the same week each year?
  - Maintainability?

Just in Time Capacity Planning

- Technique
  - Use of the Spreadsheet
    - What is the unit of measure? MIPS, Hours, or something else
  - Is there a pattern that can be discerned on a week to week basis over the span of one year to several years?
    - Example – does utilization go down or up at the same approximate week each year?
  - Can linear regression still be used and combined with the seasonal forecast to deliver an accurate forecast?
  - Are there other factors that need to be considered?
  - The foundation can be found in the Proceedings for Share 2007 and CMG 2006.

= Current week MIPS / Previous week MIPS

MIPS

WEEK	2001	2002	2003	2004	2005	2006	Diff from prev week (2001)	Diff from prev week (2002)	Diff from Prev Week (2003)	Diff from prev week (2004)	Diff from prev week (2005)	Diff from prev week (2006)	4 year seasonal average	5 year seasonal Average	6 year seasonal average
1		633	844	885	1017	1199		0.942	0.945	1.000	0.901	0.850	0.962	0.947	0.93
2		705	866	940	1044	1177		1.114	1.027	1.062	1.027	0.982	1.070	1.058	1.04
3		722	876	848	986	1192		1.024	1.011	0.902	0.944	1.013	0.979	0.970	0.98
4		713	850	928	1049	1185		0.988	0.971	1.094	1.064	0.994	1.018	1.029	1.02
5		728	922	880	1233	1273		1.021	1.084	0.948	1.175	1.074	1.018	1.057	1.06
6		731	880	937	1101	1168		1.003	0.954	1.065	0.893	0.917	1.008	0.979	0.97
7		712	736	890	1080	1112		0.974	0.837	0.949	0.981	0.952	0.920	0.935	0.94
8	539	723	920	952	1067	1163		1.016	1.250	1.070	0.988	1.046	1.033	1.081	1.07
9	595	753	993	956	1224	1231	1.104	1.042	1.080	1.004	1.147	1.059	1.032	1.075	1.07
10	583	748	887	1012	1151	1186	0.980	0.993	0.894	1.059	0.940	0.964	0.981	0.973	0.97
11	622	778	891	940	1129	1183	1.067	1.041	1.004	0.929	0.982	0.997	1.010	1.004	1.00
12	616	746	941	920	1046	1203	0.990	0.959	1.056	0.979	0.926	1.017	0.996	0.982	0.99
13	605	651	968	965	1141	1179	0.982	0.872	1.029	1.049	1.090	0.980	0.983	1.004	1.00
14	771	672	900	1021	1189	1200	1.274	1.033	0.929	1.057	1.042	1.018	1.073	1.042	1.06
15	781	734	835	962		1228	1.013	1.093	0.928	0.943	0.919	1.024	0.994	0.979	0.99
16	765	744	875	853	1123	1214	0.980	1.013	1.048	0.887	1.027	0.989	0.982	0.991	0.99

Just in Time Capacity Planning

- Results
  - Verify Variations Week to Week
    - Week 14
    - Week 51 & 52

WEEK	2001	2002	2003	2004	2005	2006	Diff from prev week (2001)	Diff from prev week (2002)	Diff from Prev Week (2003)	Diff from prev week (2004)	Diff from prev week (2005)	Diff from prev week (2006)	4 year seasonal average	5 year seasonal Average	6 year seasonal average
14	771	672	900	1021	1189	1200	1.274	1.033	0.929	1.057	1.042	1.018	1.073	1.042	1.06
15	781	734	835	962	1093	1228	1.013	1.093	0.928	0.943	0.919	1.024	0.994	0.979	0.99
51	673	552	719	1043	1082		0.982	0.677	0.831	1.003	0.867		0.873	0.872	0.87
52	597	797	885	916	1019		0.886	1.444	1.230	0.878	0.942		1.110	1.076	1.08

Just in Time Capacity Planning

Results 8 Years Later...

WEEK	Diff from Previous Week (2004)	Diff from Previous Week (2005)	Diff from Previous week (2006)	Diff from Previous Week (2007)	Diff from Previous Week (2008)	4 year Seasonal Average	5 year Seasonal Average	6 year Seasonal Average	7 Year Seasonal Average	8 Year Seasonal Average
1	1.000	0.901	0.850	0.839	0.923	0.962	0.947	0.928	0.913	0.914
2	1.062	1.027	0.982	0.984	1.122	1.070	1.058	1.042	1.033	1.045
3	0.902	0.944	1.013	1.011	0.966	0.979	0.970	0.979	0.984	0.982
4	1.094	1.064	0.994	1.030	1.024	1.018	1.029	1.022	1.023	1.024
5	0.948	1.175	1.074	1.053	0.980	1.018	1.057	1.060	1.059	1.048
6	1.065	0.893	0.917	0.948	0.966	1.008	0.979	0.967	0.964	0.964

WEEK	ACTUAL	FORECAST	Tracking to Forecast +/- 10%
1	1592	1616	-1.48
2	1786	1672	6.82
3	1726	1650	4.65
4	1768	1692	4.49
5	1732	1797	-3.58
6	1674	1735	-3.55

Just in Time Capacity Planning

- Definition of an Accurate Forecast
  - An accurate forecast is one that allows decisions to be made on when to purchase computing resources at the right time without impacting service level commitments.
  - A standard of variability of +/- 10% to the forecast
- Noise in a Forecast
  - Can a measure be used to determine noise in the forecast?

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- Observations
  - Business rate of growth doesn't vary much on a year to year basis
  - What changes are the periods of more or less activity
  - Individual workload impacts not considered in forecast
    - CICS, DB2, TSO
  - Adjustable for new work added to a system

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- One Problem
  - NOISE
    - How to identify in a short period of time whether or not the trend is NOISE or does some action have to be taken
    - What method can be used to determine if the variation from the forecast is noise or a call to action

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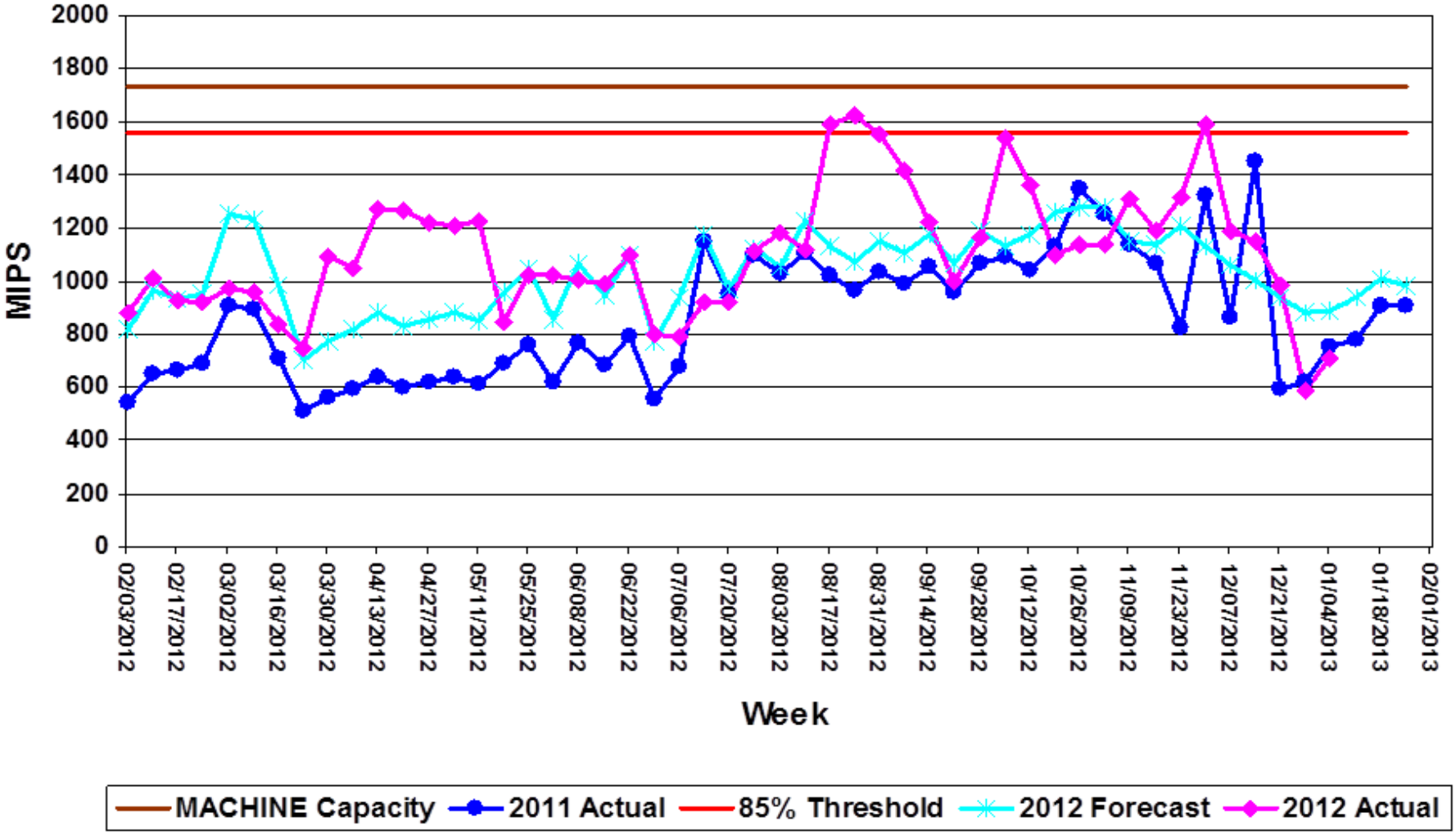

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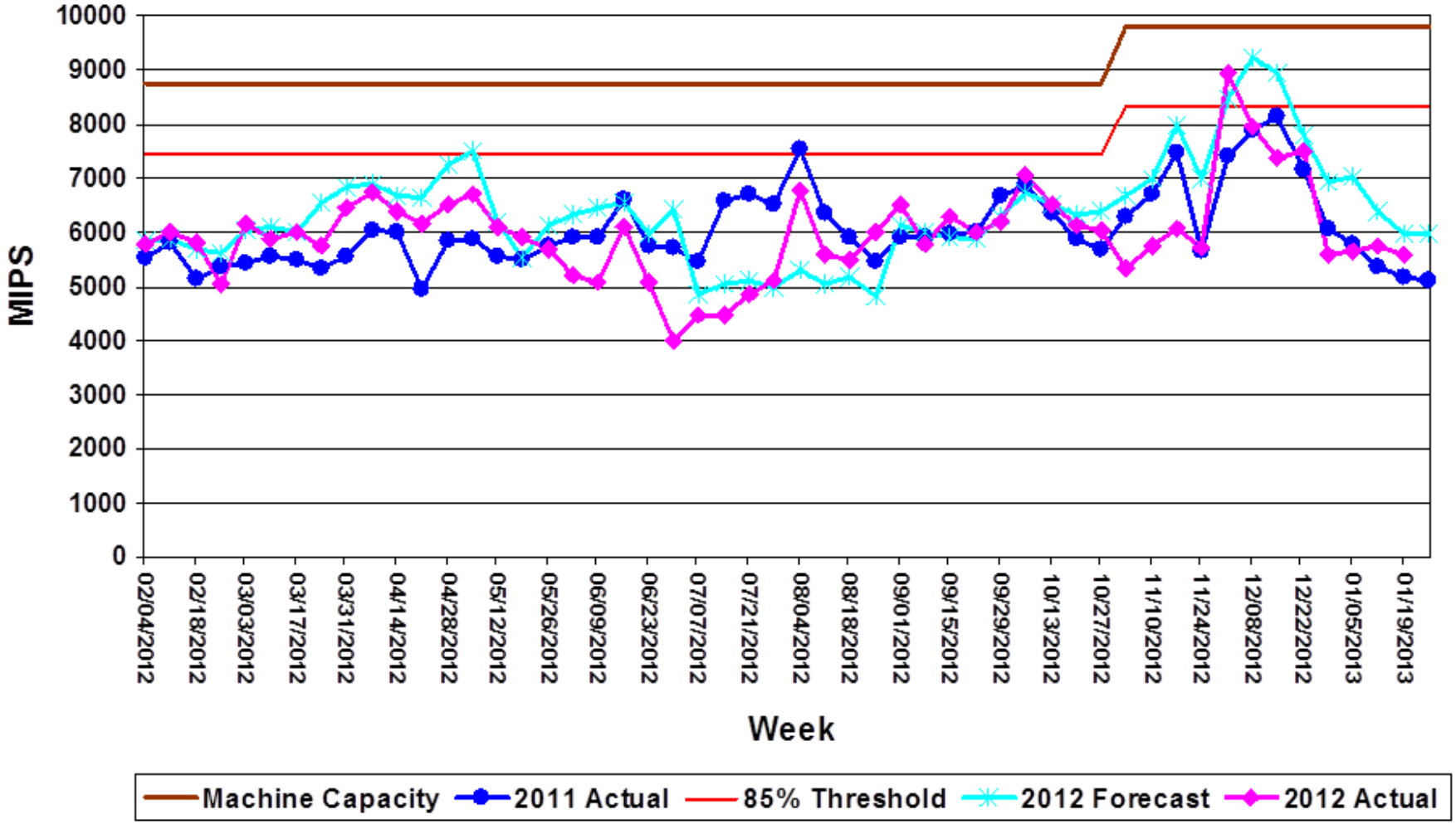

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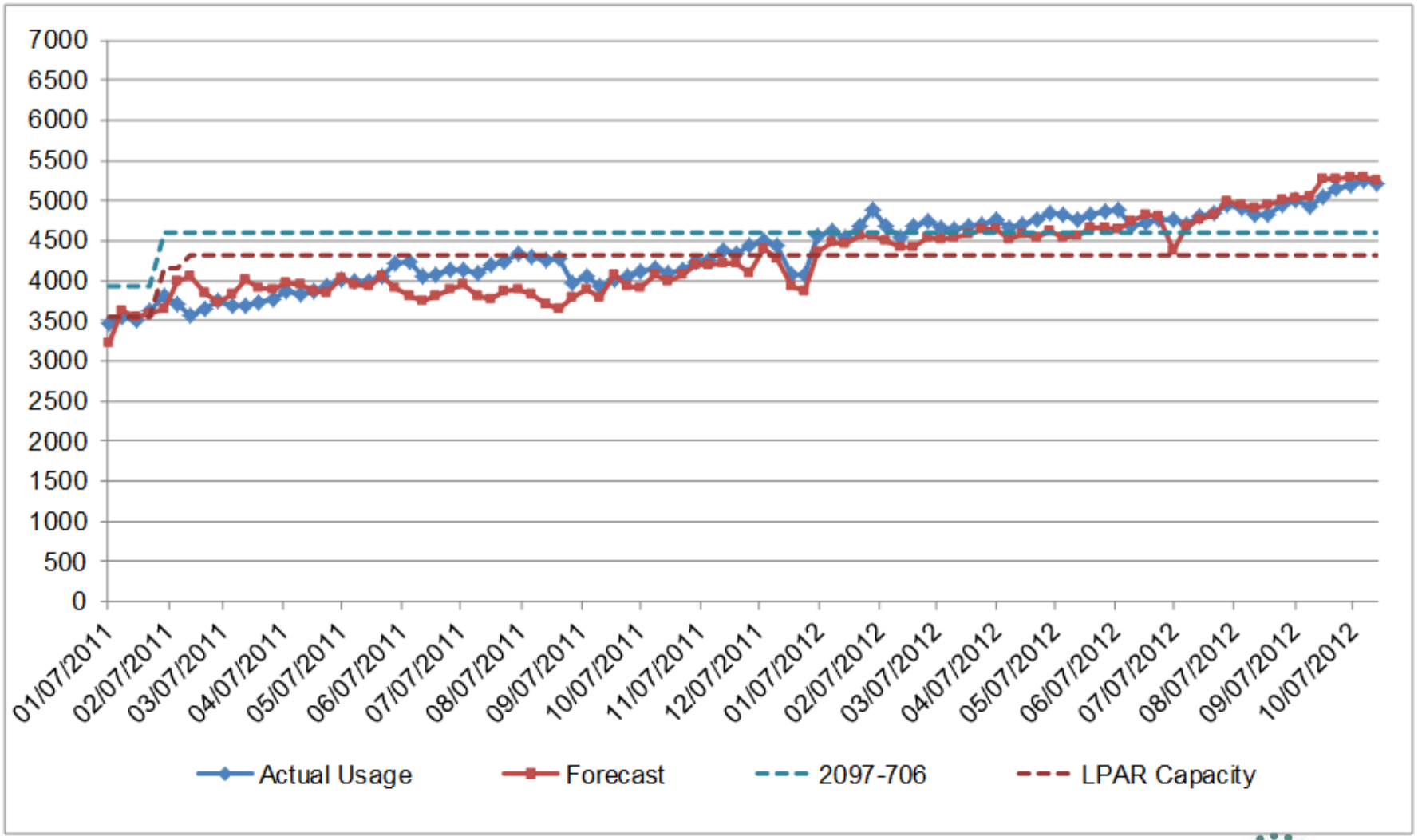

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- How to take the forecast to the next level
- Identification of Noise
  - What is noise?

Just in Time Capacity Planning

- Process Behavior Analysis
  - Statistical Control Analysis (STC) pioneered by Walter Shewhart at Bell Laboratories in the 1920's.
  - Assignable-cause and Chance-cause variation
  - Introduced control charts to distinguish between the two

Just in Time Capacity Planning

- Dr. Donald J Wheeler defined this process of control as:

  "A phenomenon will be said to be controlled when, through the use of past experience, we can predict, at least within limits, how the phenomenon will vary in the future."

  And further refined Shewhart's work:

  "A process will be said to be predictable when, through the use of past experience, we can describe at least within limits, how the process will behave in the future."

Just in Time Capacity Planning

- Upper and Lower Natural Process Limits
  - UNPL and LNPL
  - Can be calculated by multiplying the Average Moving Range by 2.66

- Results
  - A Capacity Forecast at a weekly view that accounts for the normal variance range. As long as the actual is within the bounds, the result is within the normal limits, can be considered “NOISE” and no action would be needed.

Just in Time Capacity Planning

- Examples
  - The examples will show how the implementation has aided in identifying when additional capacity is needed
  - Transcends platforms
  - Transcends the traditional view of MIPS
    - Can use other measures as long as they are repeatable and are a representation of the work that is executed on the system

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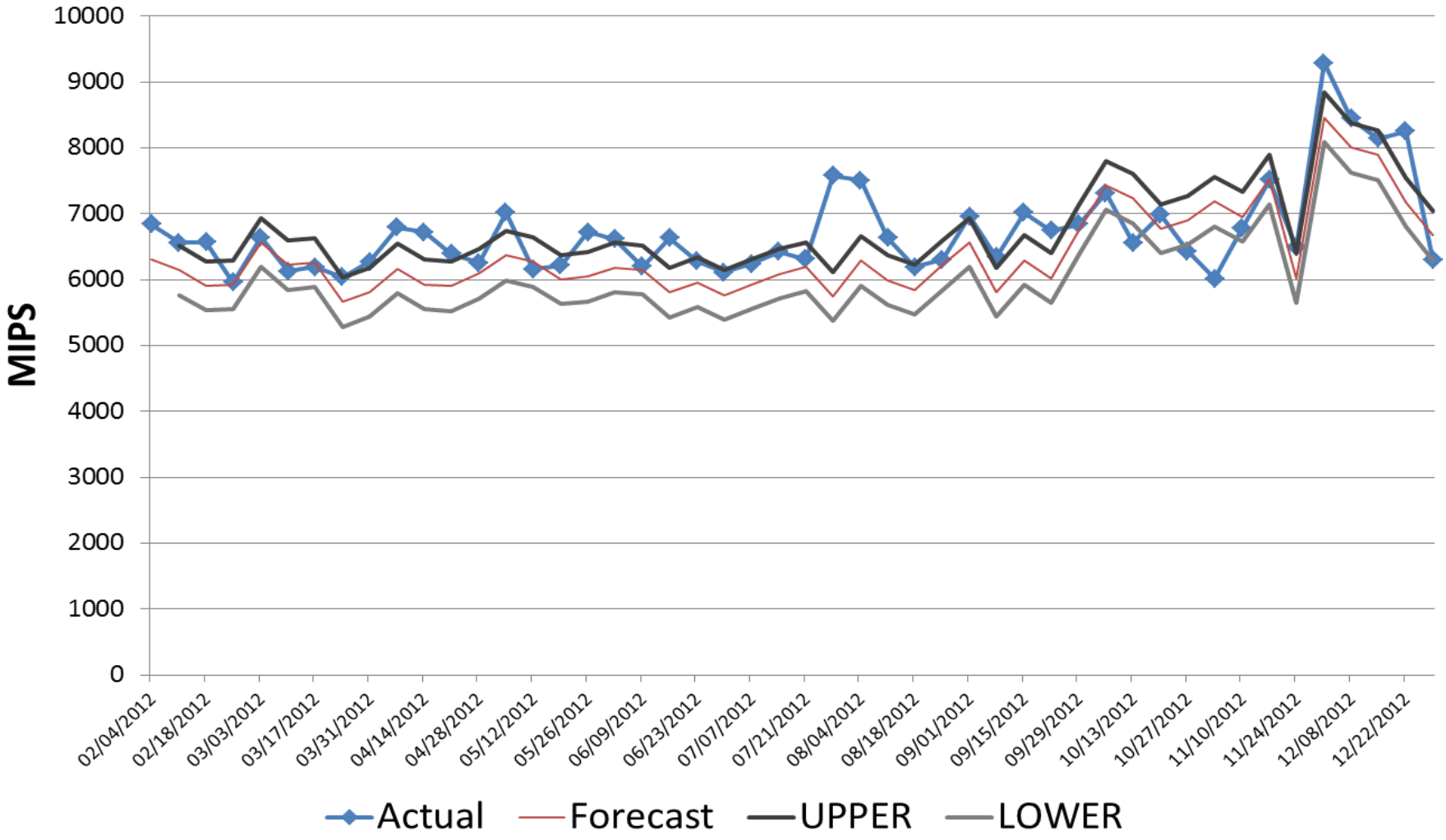

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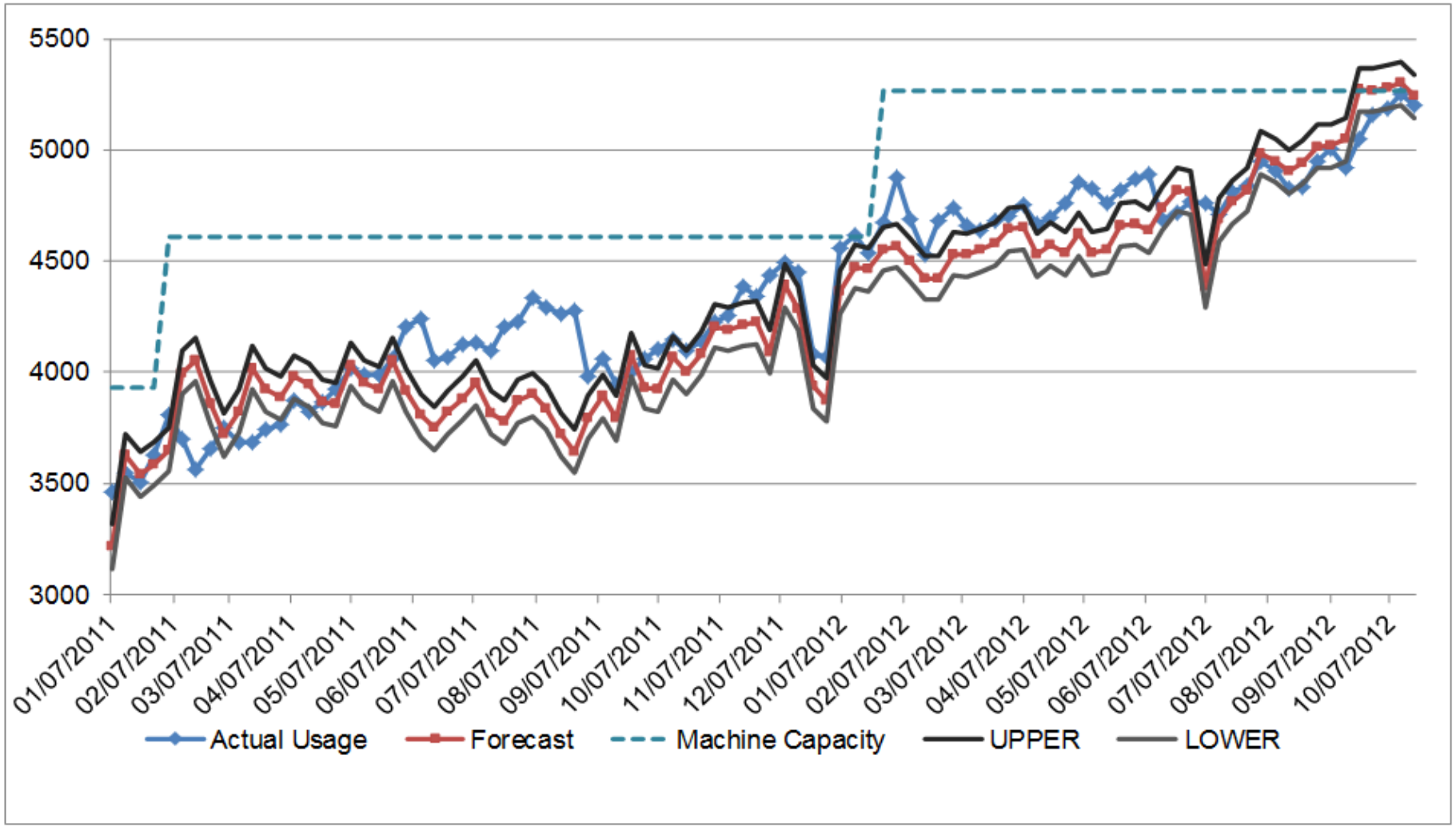

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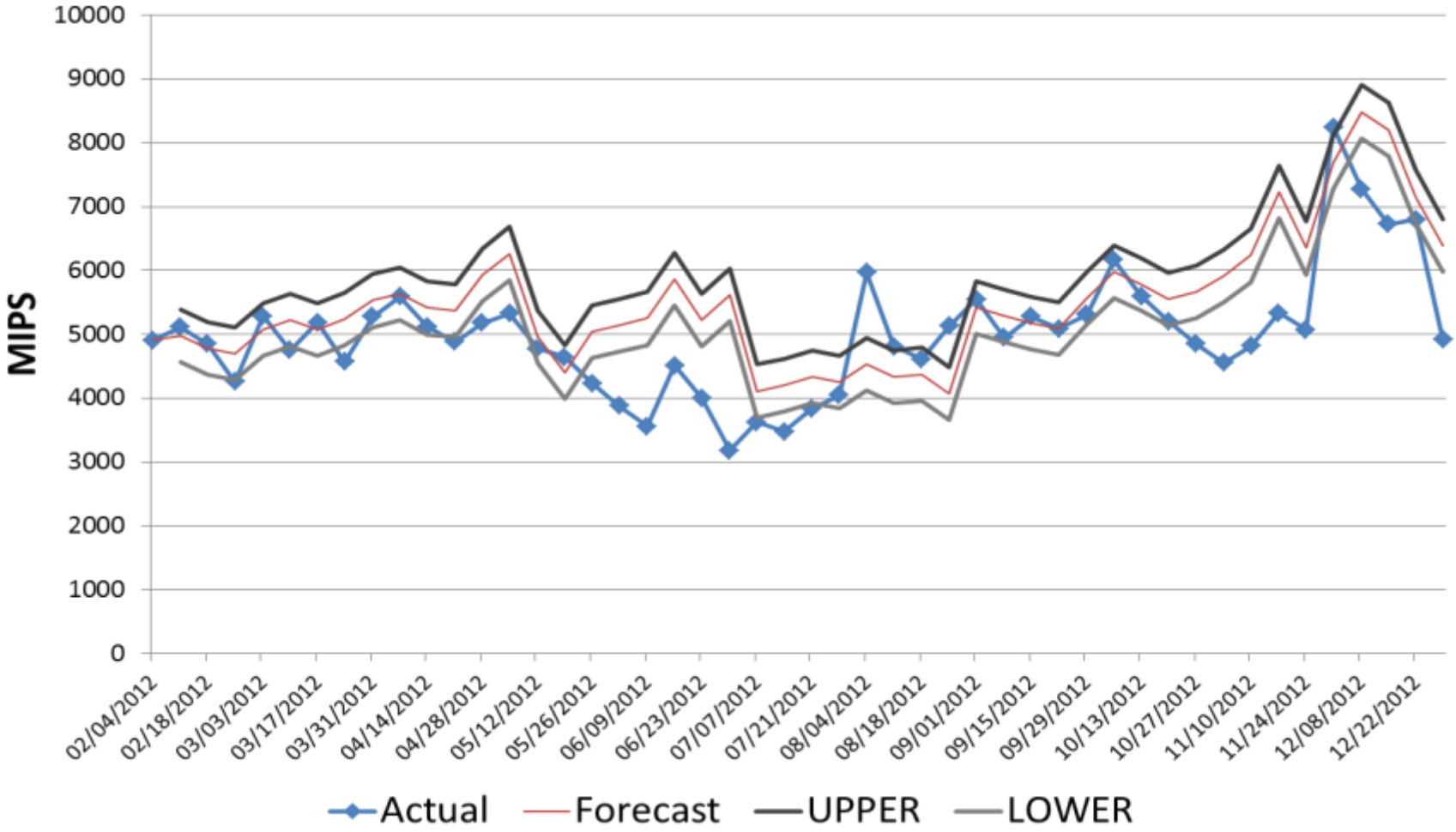

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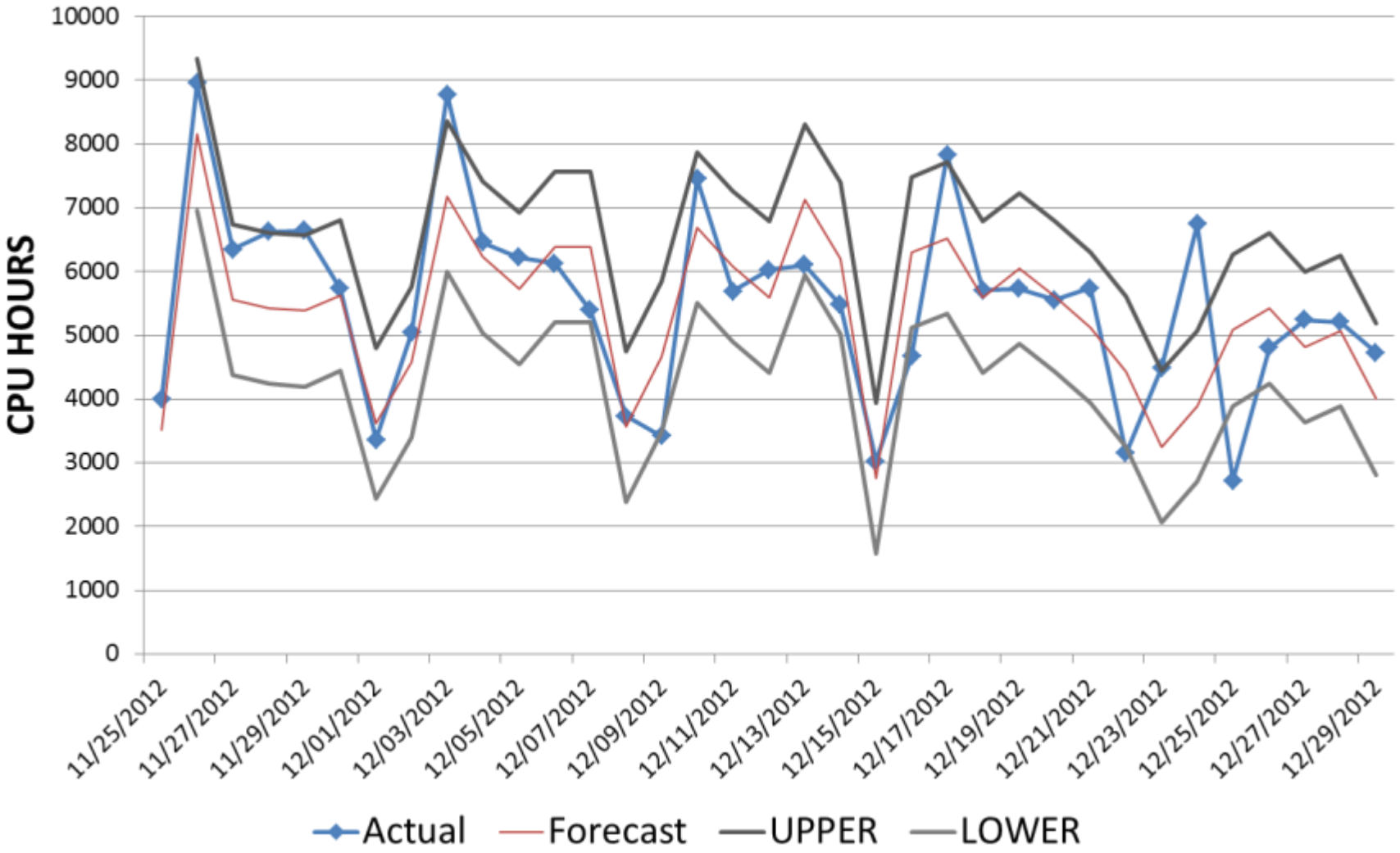

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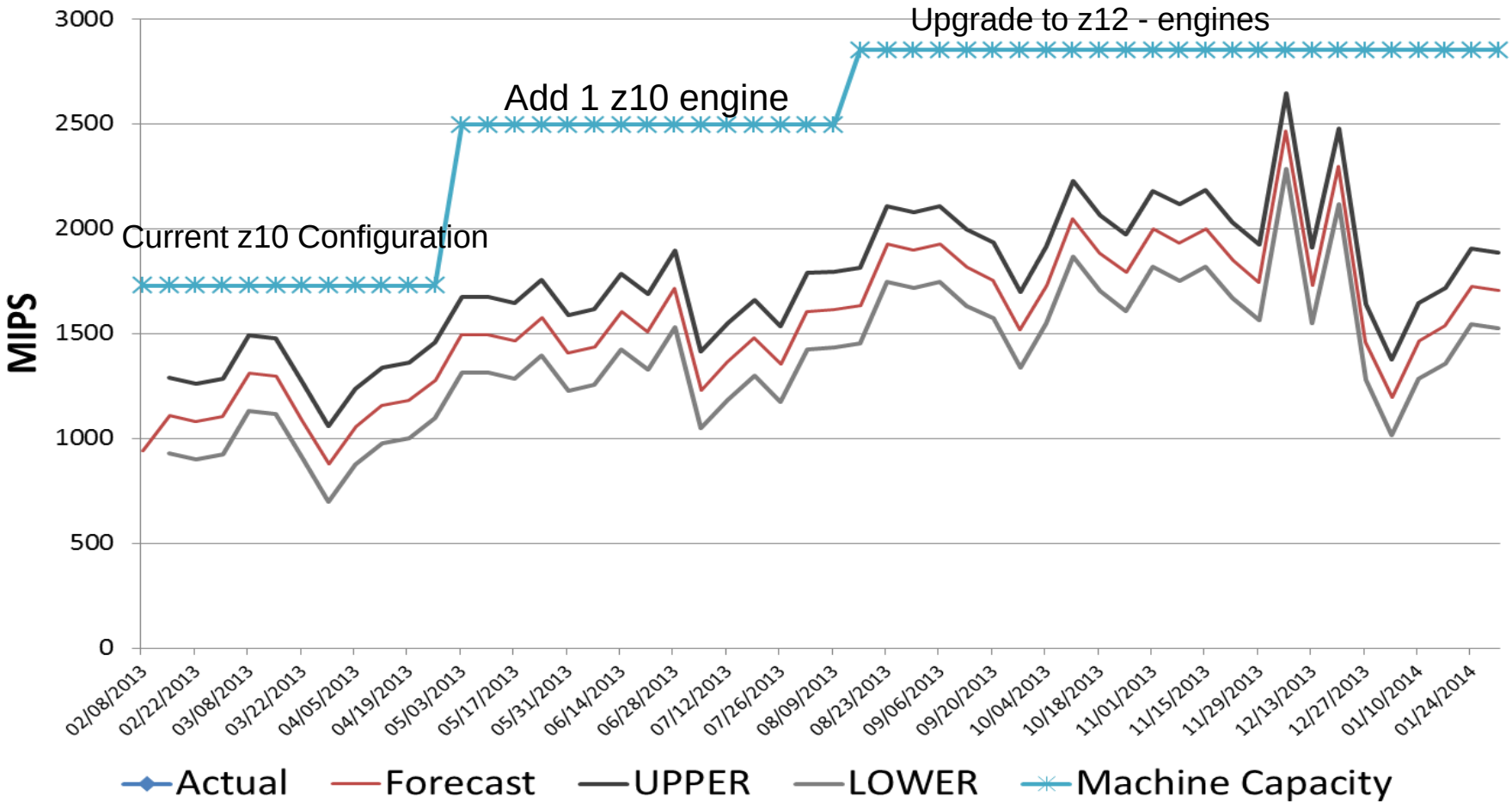
Specialty Engines



Just In Time Capacity Planning

- Results
  - A new capacity chart is created showing peaks and valleys
  - The forecast is bound with process limits which accurately identifies Noise
  - Yearly / Seasonal patterns are more discernable
  - Documents the seasonal nature of businesses
    - Seasonal/Holiday Peaks easier to identify
  - Defer or anticipate CPU needs with a high degree of confidence
  - Accuracy of forecast builds credibility
  - Forecasts reliability for longer periods of time
    - Forecasts are good for 12-18 months out
    - Proven track record for twelve years with the methodology

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Questions?

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- “A Modest Proposal” by Donald J. Wheeler, Ph.D.
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